



## S-3A BALLAST BLOCK FINAL DESIGN AND ENGINEERING TESTS

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## TABLE OF CONTENTS

	Page
LIST OF FIGURES.....	2
SUMMARY.....	3
INTRODUCTION.....	4
BACKGROUND .....	4
DESCRIPTION OF FINAL DESIGN .....	4
DISCUSSION AND TEST RESULTS .....	5
CENTER OF GRAVITY TEST.....	5
ASSEMBLY AND DISASSEMBLY ON 1E-1 SEAT AND ON AISLE STEP.....	7
EJECTION SEAT STATIC LOADS .....	8
AISLE POSITION STATIC LOADS .....	8
CONCLUSIONS .....	8
ACKNOWLEDGEMENT.....	9
REFERENCES .....	9

## LIST OF FIGURES

Figure	Title	Page
1	S-3A Ballast Block Assembled.....	10
2	S-3A Ballast Block Disassembled.....	11
3	Crewman Carrying Ballast Block Components.....	12
4	Center of Gravity Measurement .....	13
5	1000 Pound - $G_x$ Load On Seat .....	14
6	1000 Pound + $G_x$ Load in Aisle .....	15
7	500 Pound - $G_z$ .....	16
8	-1 Bottom Block in Seat .....	17
9	-2 Block Placed in Seat .....	18
10	Routing of Shoulder Restraint Straps.....	19
11	Connecting Parachute Riser Straps .....	20
12	Connecting Lap Belt Fittings.....	21
13	Tightening Straps on Seat .....	22
14	-1 Block on Aisle Step .....	23
15	-2 Block on Aisle Step.....	24
16	-3 Block on Aisle Step.....	25
17	-4 Block on Aisle Step.....	26
18	Locking Plates in Place .....	27
19	Wing Nuts on Locking Plates.....	28
20	Top View of Assembly in Aisle.....	29
21	Dwg, S-3A Ballast Block, Assembly.....	30
22	Dwg, S-3A Ballast Block, -1 Block.....	31
23	Dwg, S-3A Ballast Block, -2 Block.....	32
24	Dwg, S-3A Ballast Block, -3 Block.....	33
25	Dwg, S-3A Ballast Block, -4 Block.....	34
26	Dwg, S-3A Ballast Block, Aisle Locking Plates .....	35
27	Dwg, S-3A Ballast Block, Strap Assemblies.....	36
28	Dwg, S-3A Ballast Block, Stamping Detail.....	37
29	1E-1 Ballast Block C.G. Eccentricity with Rocket Thrustline .....	38

## SUMMARY

The third prototype S-3A Ballast Block weighs 169 pounds (77 Kg). It is an assembly of four interlocking aluminum blocks. One crewman can carry two blocks at a time into the aircraft where he can quickly assemble the unit either on the 1E-1 ejection seat or on the avionics aisleway step. Restraint on the ejection seat is obtained by connecting the four quick disconnect adjuster fittings on the ejection seat to fittings on the Ballast Block. When the Assembly is placed on the avionics aisle steps it is restrained with two aluminum locking plates which are bolted to the top block. These plates extend beyond the edges of the block and fit into keyways on either side of the main bulkhead forgings directly behind the aft ejection seats.

When the Block is secured on the 1E1-1 seat the overall center of gravity falls 0.72 inches below the centerline of rocket thrust. The Ballast Block meets all operational and structural requirements for safe function in the aircraft. It can be maintained at the Operational level; the only parts that may need replacement are straps which are readily available.

The S-3A Ballast Block provides a simple and cost effective replacement for anthropomorphic dummies presently being used to ballast unoccupied 1E1 ejection seats.

## INTRODUCTION

### BACKGROUND

The S-3A aircraft has (4) ejection seats. Both the pilot and copilot have Command Eject Selector levers which allow them the option to eject all crewmembers or "Self Eject." If one of the aft seats is unoccupied, and "Command Eject" is selected, the unoccupied seat will accelerate ahead of the occupied seat next to it. Two hazards exist; first, the crewmember next to the unoccupied seat could be burned by the rocket plume from the empty seat which has a higher acceleration; second, the empty seat could tumble into one of the other seats because the center of gravity and the center of rocket thrust are too far apart. To eliminate these hazards it is necessary to ballast the unoccupied seat. This is presently being done with anthropomorphic test dummies, if they can be obtained. Unfortunately these dummies have various weights and are usually damaged (i.e. arms, legs, or head missing). There is no guarantee that the center of gravity is in the proper location to prevent tumbling. To correct this potentially dangerous situation the Naval Air Systems Command tasked the Naval Air Development Center to design a ballast block. After the initial prototype was developed and tested, references (1) and (2) recommended changes to be incorporated into the final design. All of these recommendations have been incorporated into the final design.

### DESCRIPTION OF FINAL DESIGN

The S-3A Ballast Block is an assembly of four (4) interlocking aluminum blocks that can be strapped into an ESCAPAC 1E-1 seat and can also be securely stored in the aisle on the avionics bay step of the S-3A aircraft (figures 1 & 2).

Two blocks at a time can be carried by one man (figure 3). Each block weighs about 42 pounds (19 Kg).

Straps on the top and bottom blocks have quick disconnect fittings that mate with the parachute/inertia reel straps and with the survival kit straps to mount the assembly on the 1E1 ejection seat (figure 11).

Each block has a handle and a finger ledge on two sides that enable the crewmember to assemble the blocks on the seat without danger of pinching fingers (figure 4).

The center of gravity of the block/seat assembly falls less than one inch (three centimeters) below the center of the rocket thrustline (figure 29).

Aluminum is used to make the assembly antimagnetic so as not to interfere with submarine detection systems.

Each block is stenciled with its number to simplify assembly (figure 1).

Two locking plates are bolted to the top block. They are used to lock the assembly in the aisle position for catapult, arrestment, and flight loads (figure 19).

## DISCUSSION AND TEST RESULTS

After the second prototype S-3A Block Assembly (reference 1) was tested at the Naval Air Test Center several problems were uncovered (reference 2);

- a. The method for stowing the assembly in the aircraft aisle was not adequate.
- b. Steel blocks could possibly interfere with the aircraft Magnetic Anomaly Detector (MAD) system.

A third prototype Block was designed and fabricated using aluminum. It also was taken to the Naval Air Test Center for fit and function tests. In addition, static loads were placed on the assembly to determine if the seat restraint straps and the aisle restraint plates were adequate for 10 G crash, catapult, arrestment, and flight loads.

The final configuration of the Ballast Block is shown on the drawings (figures 21 through 28). It differs from the tested assembly as follows;

- a. The final design does not incorporate a rear finger ledge on each block because the crewmen did not use it during evaluation: this ledge was machined into the test blocks.
- b. The final - 1 block is 14.12 inches long in order to completely span the Avionics Bay step; the test - 1 block was 13.0 inches long.

These changes will improve the performance of the assembly by increasing its weight, and shifting the center of gravity a bit closer to the rocket thrustline.

### CENTER OF GRAVITY TEST (figure 4)

Through a series of ESCAPAC seat suspension tests and mathematical calculations the eccentricity of the 1E1-1 seat/ballast block center of gravity was determined to lie 0.72 inches (1.8 cm) below the rocket thrustline (figure 29). Since the STAPAC rocket is capable of maintaining pitch stabilization of the seat up to an eccentricity of 2.0 inches (5.1 cm) the seat should be adequately stabilized.

The 1E1 ejection seat was designed so that the MK16 rocket thrustline lies about one inch below the seat/50 percentile-man center of gravity. During catapult acceleration the overall center of gravity will shift close to the rocket thrustline to minimize the torque rotating the seat. It is expected that the Ballast Block Assembly will not shift more than 1/8 inch (0.3 cm) downward during the catapult acceleration, and therefore the seat/block center of gravity will shift about half of this amount.

Pitch stabilization is further enhanced due to the lower moment of inertia of the seat/block compared to that of a seat/human, therefore the STAPAC rocket will have greater control on the seat at lower air speeds. At high airspeeds the aerodynamic forces control the seat trajectory more than the rocket force.

## CENTER OF GRAVITY OF 1E-1 SEAT WITH S-3A BALLAST BLOCK

## TEST CONDITIONS:

1. Ballast Block assembly tested without fore and aft extensions on bottom block.
2. IG-2 ESCAPAC seat used with parachute, empty RSSK, and empty catapult.
3. All measurements made from lower seat roller; Z along roller centerline.

## DATA:

$$\text{Weight of Ballast Block} \quad W_B = 164.0 \text{ pounds}$$

$$\text{Weight of IG-2 seat} \quad W_{IG-2} = 108.3$$

$$\text{Weight of 1E-1 seat complete (empty)} \quad W_{1E1} = 146.9$$

$$\text{C.G. of IG-2 seat with Block} \quad \begin{matrix} X \\ Z \end{matrix} \\ (12.9, 14.7) \text{ inches}$$

$$\text{C.G. of IG-2 seat empty} \quad (7.9, 17.2)$$

$$\text{C.G. of 1E-1 seat complete (empty)} \quad (7.9, 15.0)$$

MK 16 Rocket thrustline intercepts roller centerline 6.8 inches above bottom roller; 57 degrees from roller centerline

## CALCULATIONS:

## I LOCATION OF BLOCK C.G. RELATIVE TO BOTTOM ROLLER OF IG-2 SEAT

$$W_{IG-2} \cdot X_{IG-2} + W_B \cdot X_B = W_{IG-2/B} \cdot X_{IG-2/B}$$

$$(108.3) 7.9 + 164.0 X_B = (108.3 + 164.0) 12.9$$

$$X_B = 16.2$$

$$W_{IG-2} \cdot Z_{IG-2} + W_B \cdot Z_B = W_{IG-2/B} \cdot Z_{IG-2/B}$$

$$(108.3) 17.2 + 164.0 Z_B = (108.3 + 164.0) 14.7$$

$$Z_B = 13.0$$

## II LOCATION OF 1E-1 SEAT/BALLAST BLOCK CENTER OF GRAVITY

$$W_{1E-1} \cdot X_{1E-1} + W_B \cdot X_B = W_{1E1-1/B} \cdot X_{1E-1/B}$$

$$(146.9) 7.9 + (164.0) 16.2 = (146.9 + 164.0) X_{1E-1/B}$$

$$X_{1E-1/B} = 12.3$$

$$W_{1E-1} \cdot Z_{1E-1} + W_B \cdot Z_B = W_{1E1-1/B} \cdot Z_{1E-1/B}$$

$$(146.9) 15.0 + (164.0) 13.0 = (310.9) Z_{1E-1/B}$$

$$Z_{1E-1/B} = 13.9$$

## III. ROCKET THRUST ECCENTRICITY WITH 1E-1 SEAT/BLOCK CENTER OF GRAVITY

$$\begin{aligned}
 \text{slope of rocket thrustline} & \quad m = \tan(90^\circ - 57^\circ) = .649 \\
 \text{slope of perpendicular to thrustline} & \quad m_{\perp} = -\frac{1}{M} = -\frac{1}{.649} = -1.54 \\
 \text{rocket thrustline equation} & \quad Z = 0.649 x + 6.8 \\
 \text{line perpendicular to thrustline thru 1E-1/block C.G.} & \\
 Z &= -1.54 x + b \\
 13.9 &= -1.54 (12.3) + b \\
 b &= 32.8 \\
 Z &= -1.54 x + 32.8
 \end{aligned}$$

## INTERCEPT OF BOTH LINES (ROCKET THRUST AND PERPENDICULAR)

$$\begin{cases} Z = 0.649 x + 6.8 & Z = 0.649 (11.9) + 6.8 \\ Z = -1.54 x + 32.8 & Z = 14.5 \text{ inches} \end{cases}$$

$$2.19 x = 32.8 - 6.8$$

$$X = 11.9 \text{ inches}$$

## C.G. ECCENTRICITY

$$e = [(Z_2 - Z_1)^2 + (X_2 - X_1)^2]^{1/2}$$

$$e = [(14.5 - 13.9)^2 + (11.9 - 12.3)^2]^{1/2}$$

$$e = 0.72 \text{ inches below thrustline}$$

## ASSEMBLY AND DISASSEMBLY ON THE 1E-1 SEAT AND ON THE AISLE STEP

Two blocks at a time can be carried to the aircraft by one crewmember (figure 3).

The first block (-1 Block) should be placed on the RSSK-8A survival kit so that the aft tabs rest against the survival kit back fittings (figure 8). After the other three blocks are stacked onto the seat (figure 9) the shoulder restraint straps are routed up through the block handles and connected to the parachute risers (figures 10, 11). Then the 'lap belt' on the top block is connected to the survival kit straps (figures 12, 13). All straps are then tightened, and the inertia reel lever is placed in the 'lock' position.

When the Assembly is to be stowed on the avionics aisle step the -1 Block is placed with the handle towards the aircraft's port side, and the block tangs slide under the lip of the step bulkhead (figure 14). The other three blocks are then stacked on top (figures 15, 16, 17), then the top locking plates are slid into the bulkhead forgings and secured by the two wing nuts (figures 18, 19, 20).

## EJECTION SEAT STATIC LOADS

The existing seat lap belt/shoulder harness straps are used to restrain the Ballast Block Assembly. Since these straps are qualified for crash loads it was decided that one test would be sufficient to verify structural integrity of the assembly on the seat.

Forward — A forward load of 1000 pounds was applied to the block assembly simulating a -6 Gx arrested landing; no problems were encountered (figure 5).

Aft — When subjected to catapult loads the Block Assembly is prevented from moving aft by the lap belt strap and seat back. No test was conducted.

Vertical — For vertical loads the Assembly is restrained by the lap belt and seat bucket which are capable of handling all Gz flight or crash design loads on the aircrewman. No test was conducted.

Lateral — Lateral stability is assured by the bottom block side tabs (figure 8) which limit the block center of gravity movement to about 1/2 inch (1.3 cm); this translates to less than 1/4 inch (0.6 cm) of seat/block center of gravity movement. No test was conducted.

## AISLE POSITION STATIC LOADS

Aft (Catapult) Loads (figure 6) — A ratchet winch was used to place a 1000 pound aft load on the block assembly to simulate a +6 Gx catapult launch. No problems were encountered.

Forward (Arrestment) Loads — No test was conducted because the Block Assembly contacts the lower section of the avionics bay bulkhead. The entire center aircraft structure would have to fail before the Block Assembly could break loose.

Upward (-Gz) Flight Loads (figure 7) — A ratchet winch was used to place a 500 pound upward load on the Assembly to simulate a -2Gz flight load. This exceeds the design flight loads of the aircraft. No problems were encountered.

Side ( $\pm$  Gy) Loads (figure 20) — The aisle locking plates limit the lateral motion of the top block to  $\pm$  1/4 inch (1 centimeter). The bottom block is limited to the same motion before contacting the sides of the aisle. No tests were necessary.

Downward (+Gz) Crash Loads — There is a requirement that all new equipment installed in the aircraft must be capable of withstanding a crash load of 10G without breaking loose from its support points. Since the bottom block of the assembly completely spans the avionics bay step the foam core aluminum step has no bending loads. All the load can easily be taken into the angles which support the step (figure 14). Even if the step should fail the Block Assembly would be limited in its vertical motion because of the electronic equipment directly beneath the step. No actual test was conducted.

## CONCLUSIONS

1. The S-3A Ballast Block meets all operational and structural requirements for safe utilization in the aircraft.
2. The Ballast Block provides a simple and cost effective replacement for the anthropomorphic dummies presently being used to ballast unoccupied 1E-1 ejection seats.

ACKNOWLEDGEMENTS

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1. Lorch, Dan, 4 Nov 1981, Development of An Ejection Seat Ballast Block for the S-3A Aircraft, Report No. NADC-81272-60 Naval Air Development Center, Warminster, PA 18974.
2. Stark, G/Sparks, T., AME 1, July 1981 Feasibility Evaluation of Proposed S-3A Aircraft Ejection Seat Ballast Block Report No. SY-62R-82 Naval Air Test Center, Patuxent River, MD 20670.

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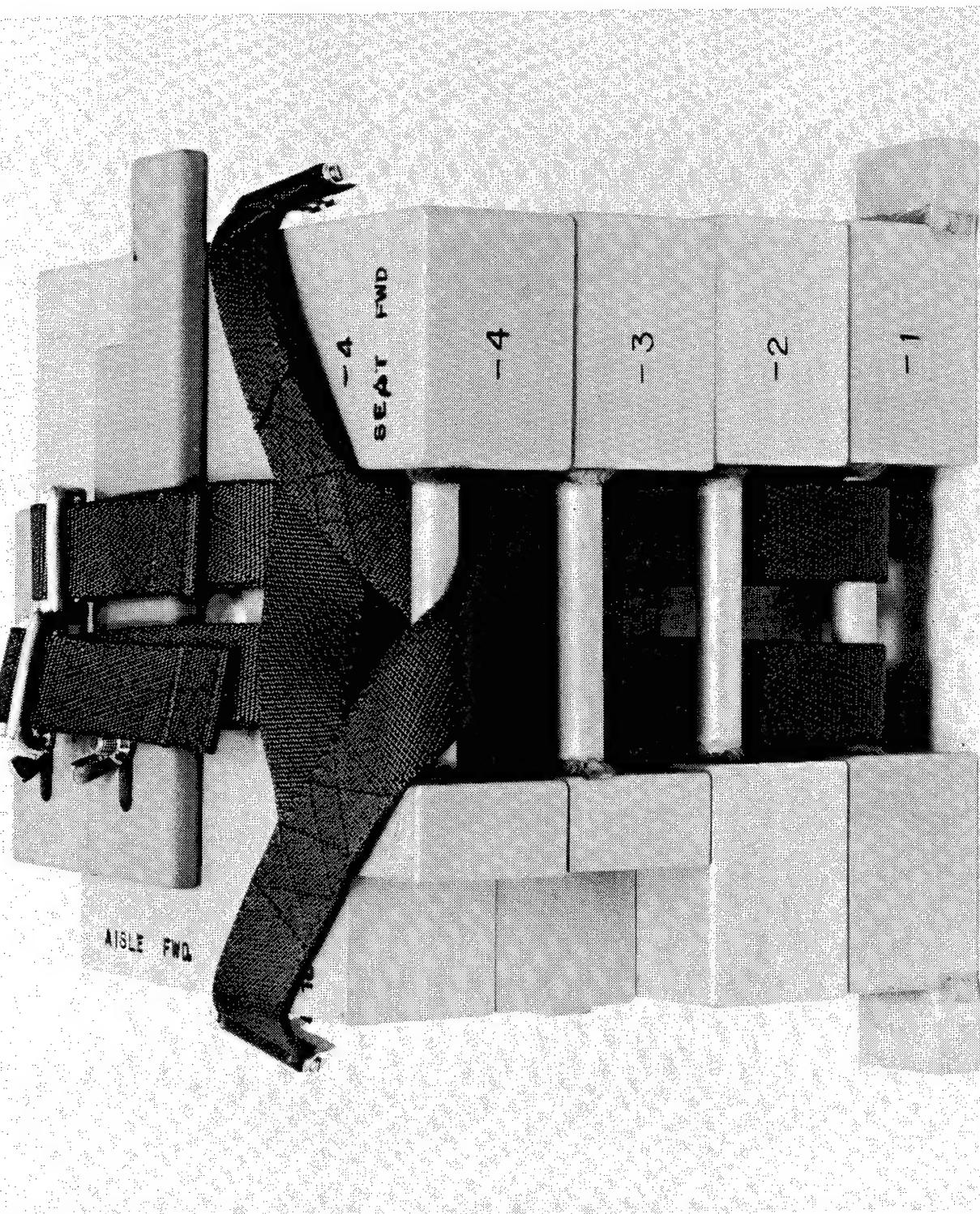


Figure 1. S-3A Ballast Block Assembled

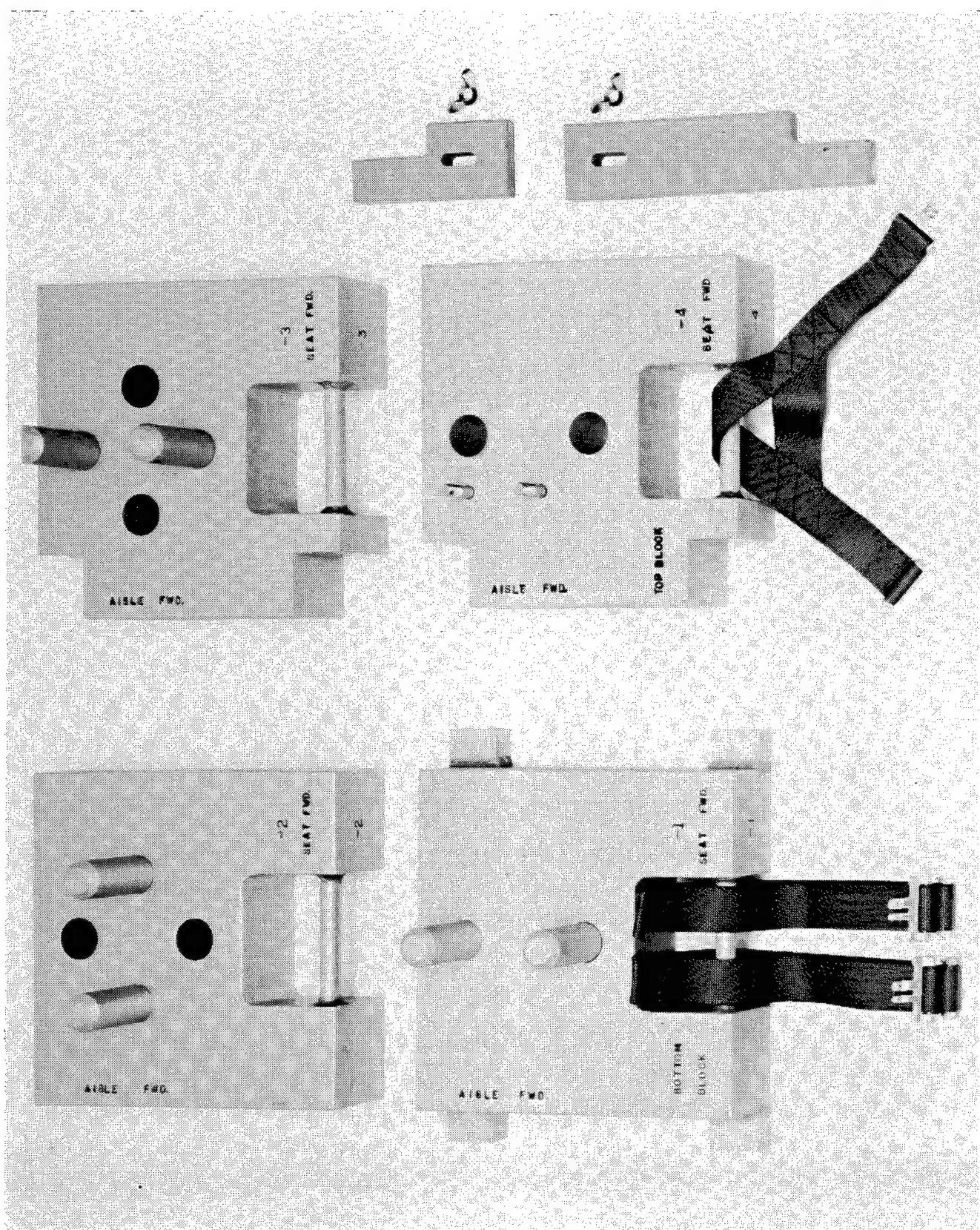


Figure 2. S3A Ballast Block Disassembled

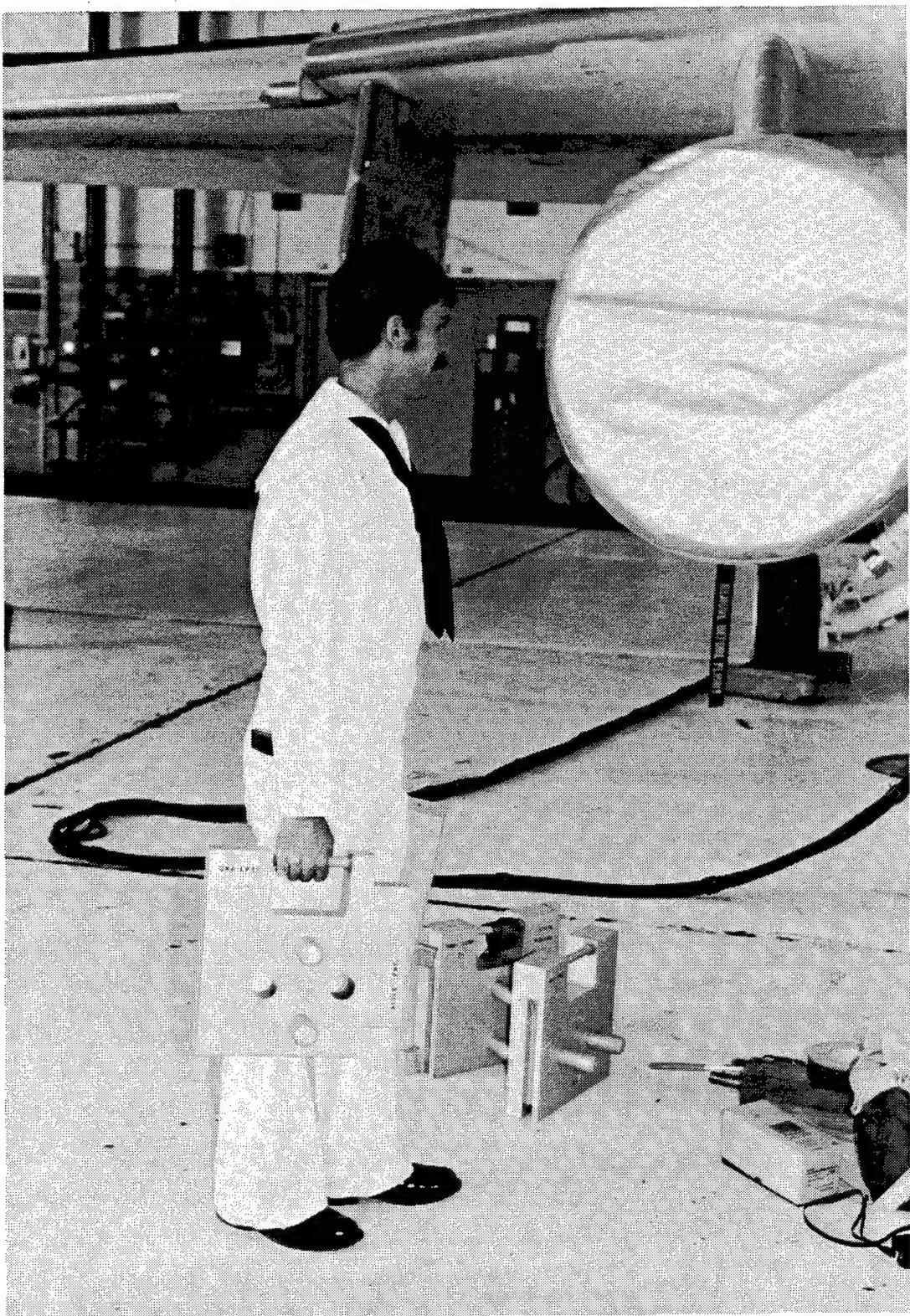


Figure 3. Crewman Carrying Ballast Block Components

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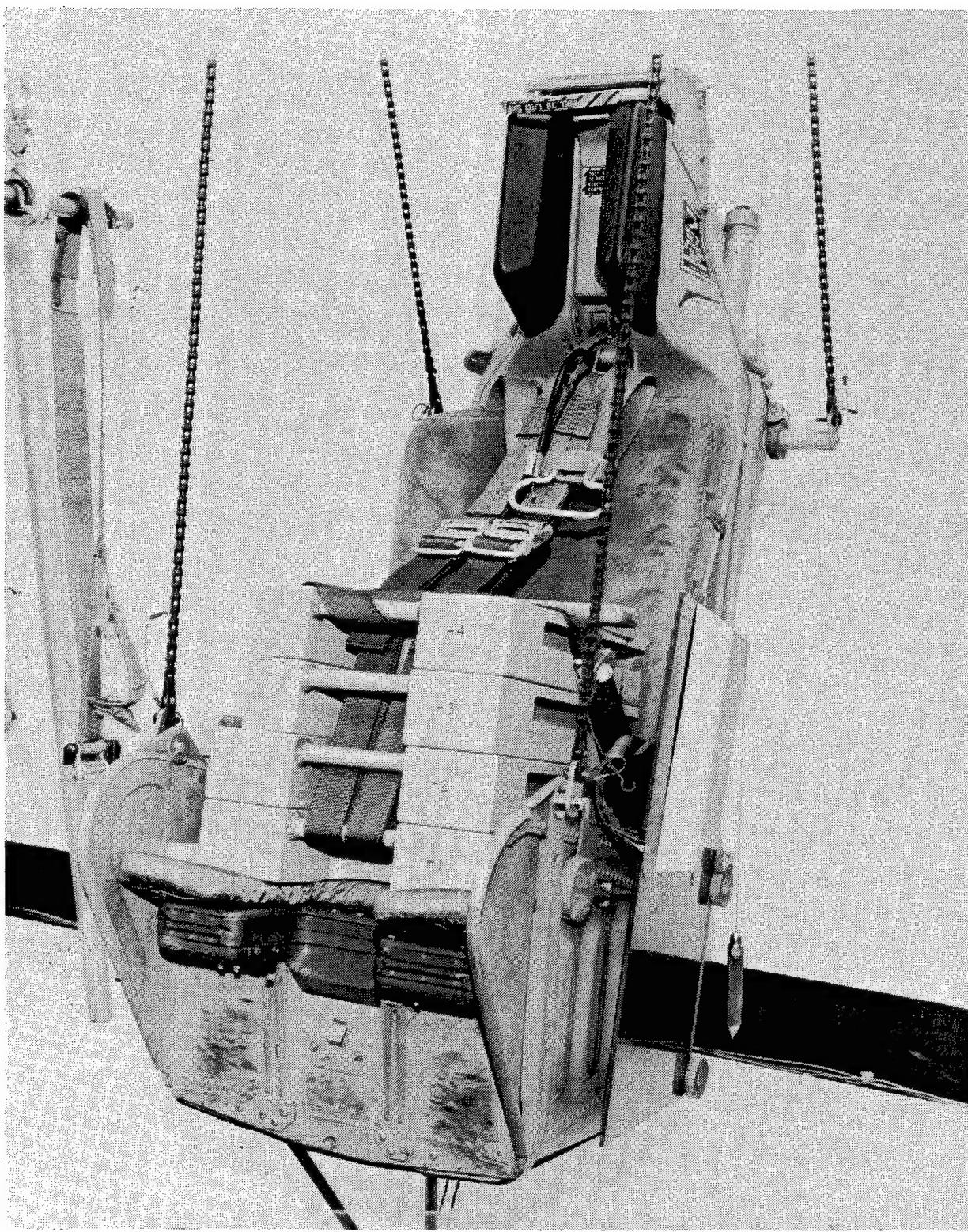


Figure 4. Center of Gravity Measurement

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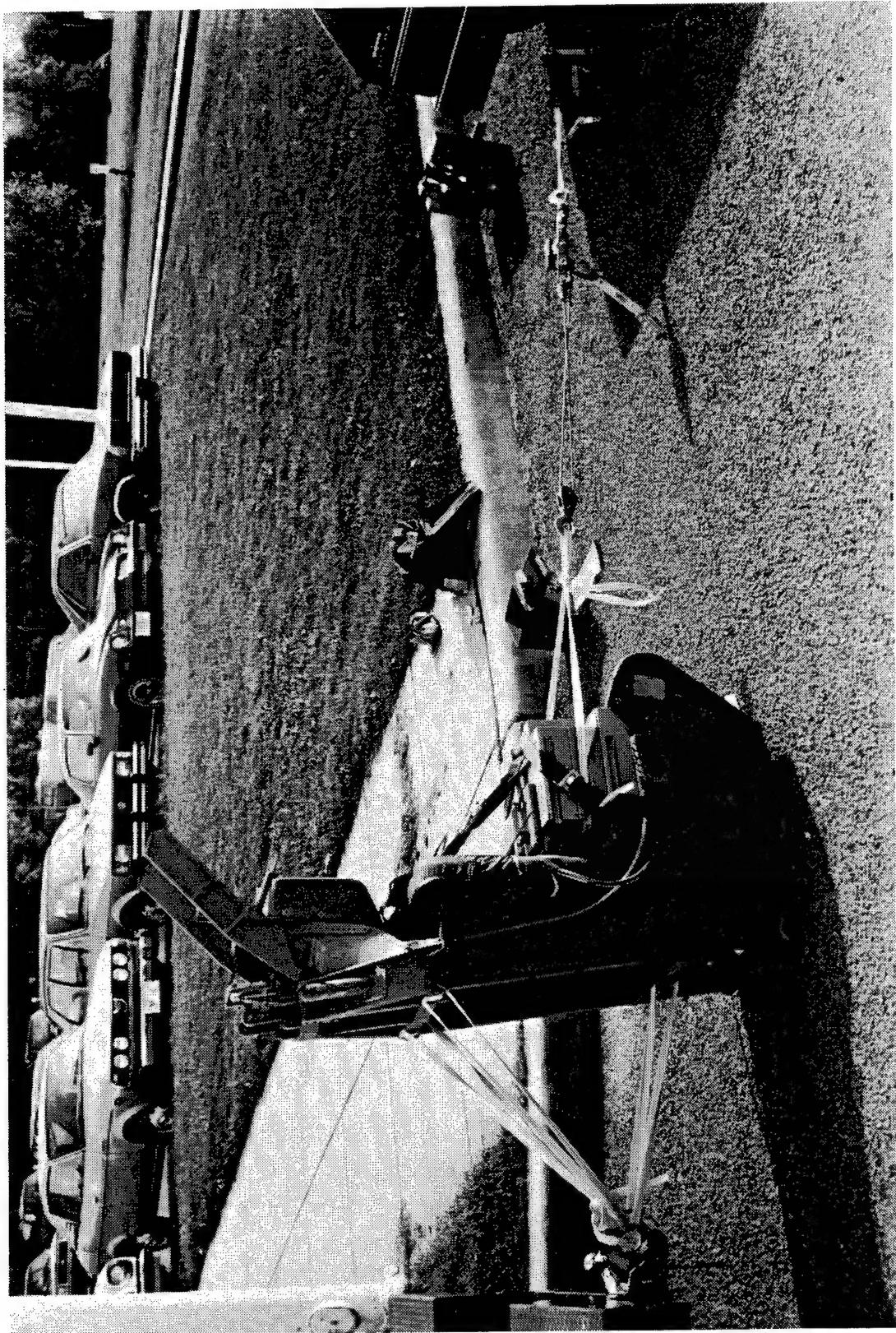


Figure 5. 1000 Pound - Gx Load On Seat

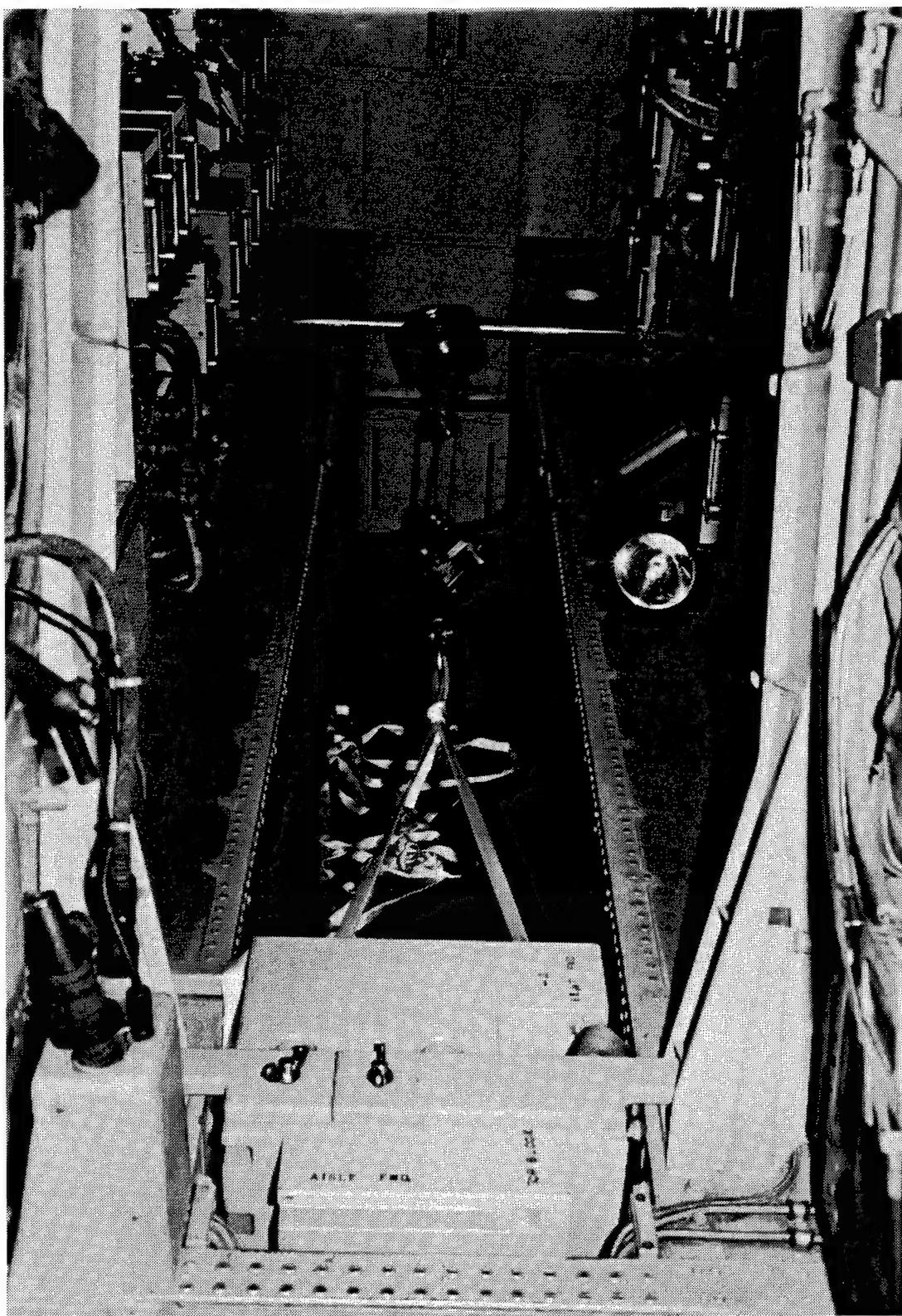


Figure 6. 1000 Pound +G<sub>x</sub> Load in Aisle

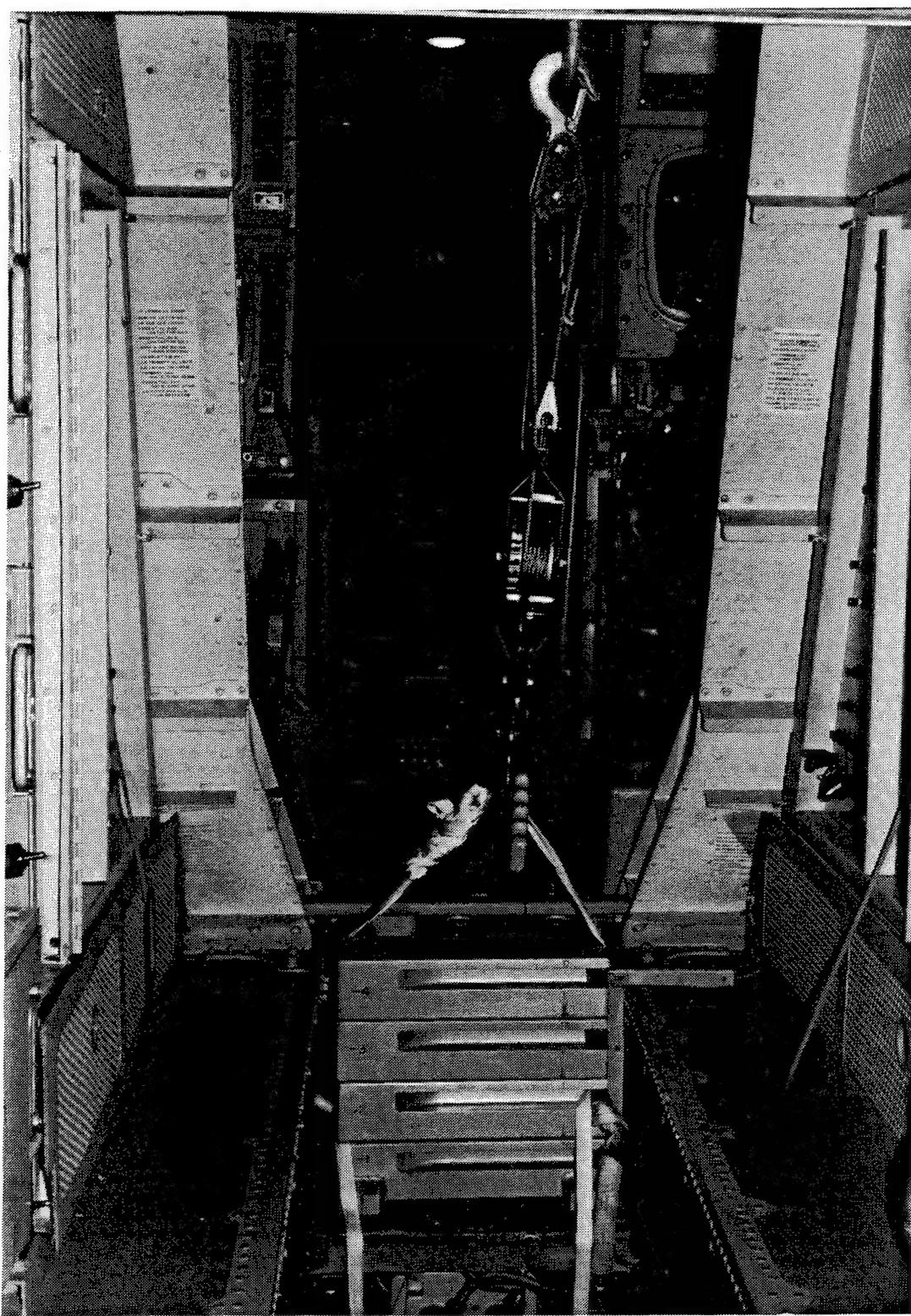


Figure 7. 500 Pound -G<sub>z</sub> Load in Aisle

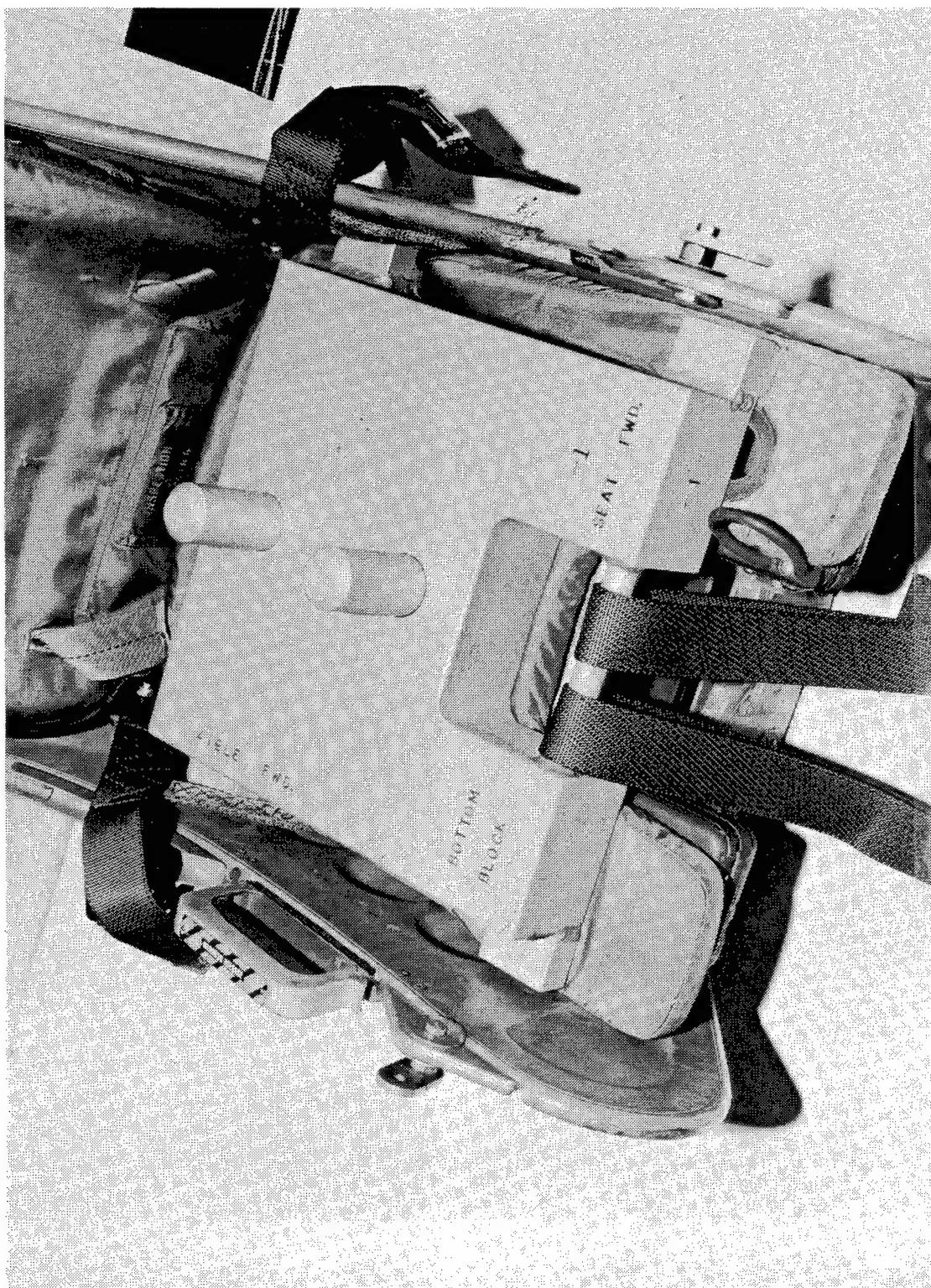


Figure 8.-1 Bottom Block in Seat



Figure 9.—2 Block Placed in Seat

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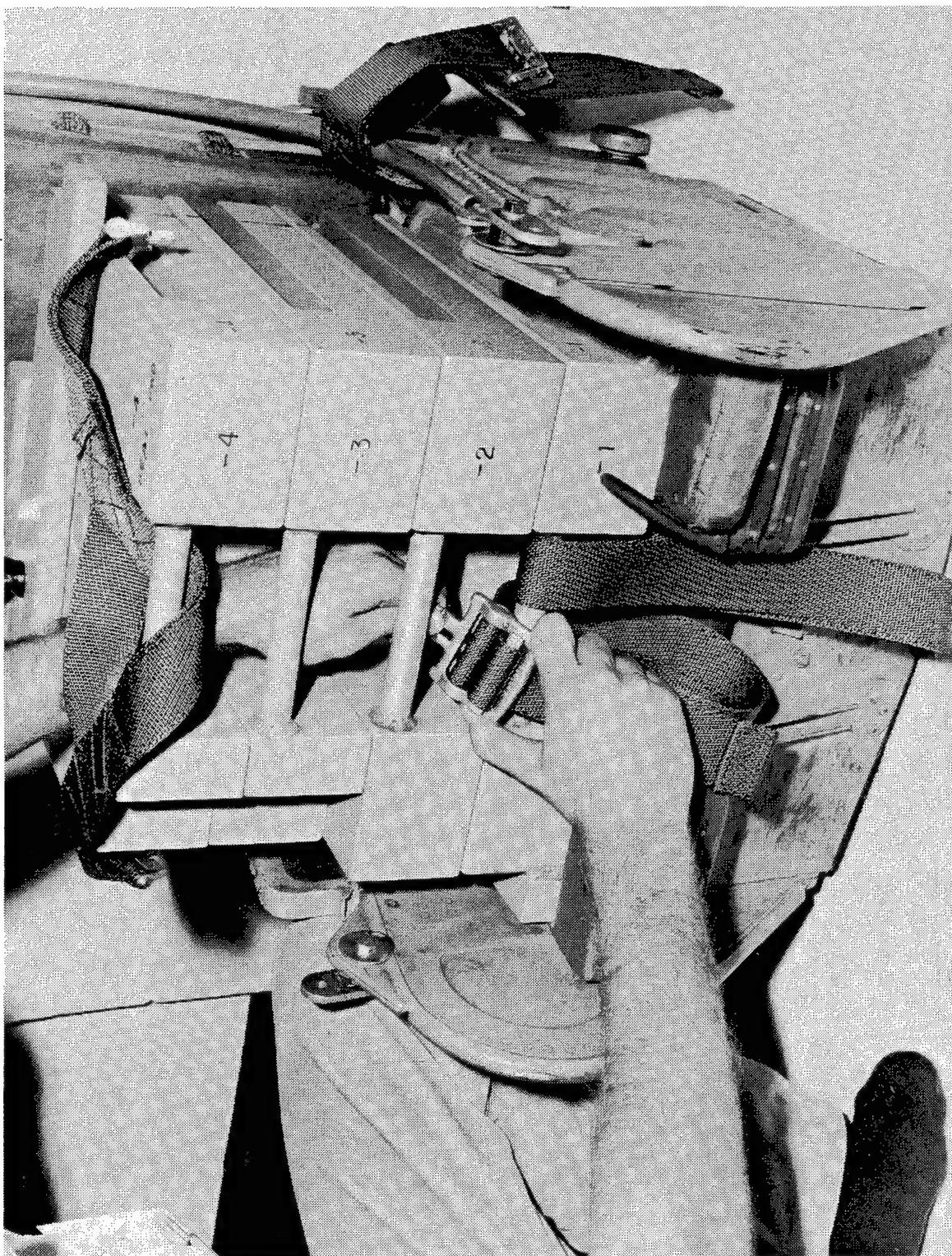


Figure 10. Routing of Shoulder Restraint Straps

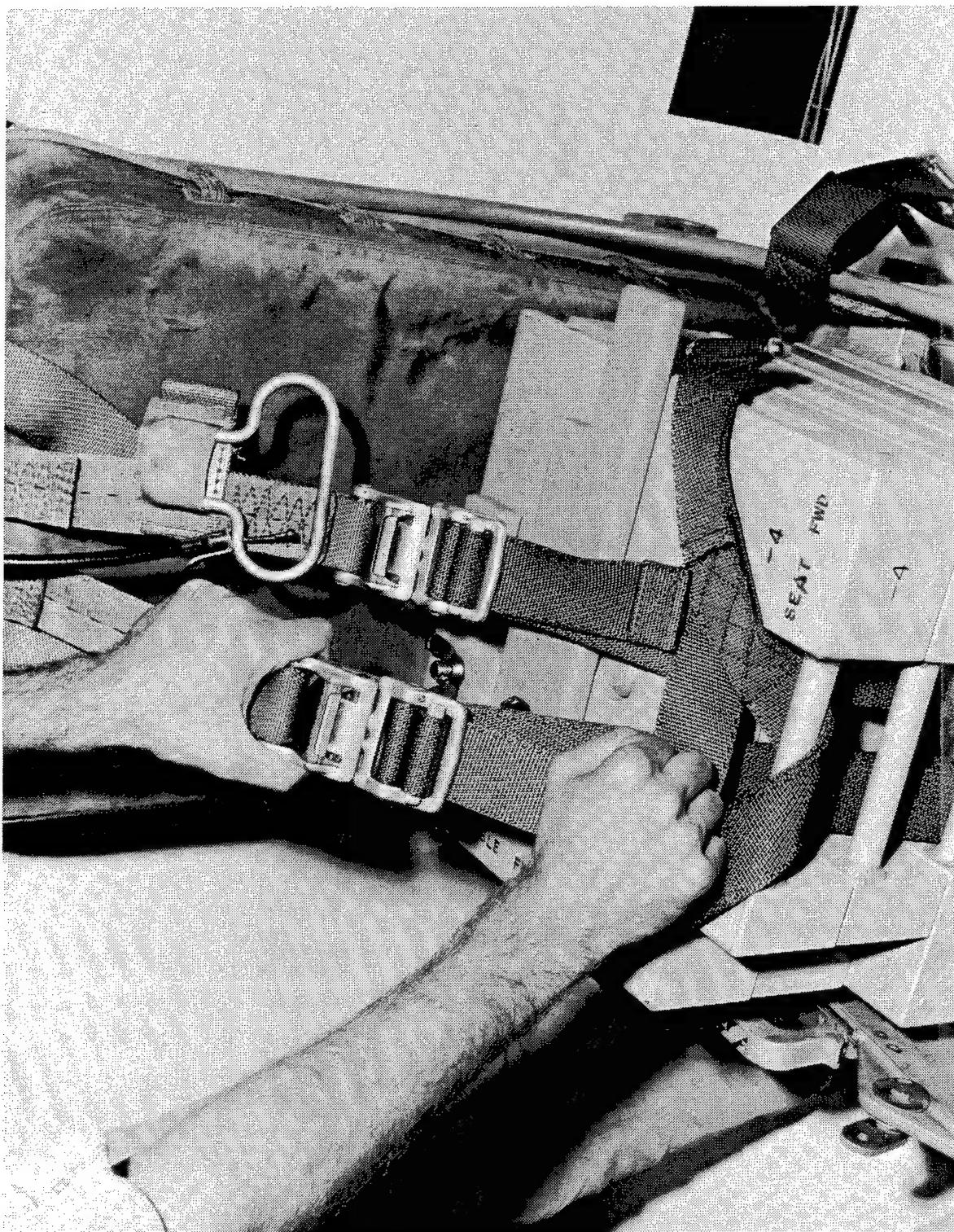


Figure 11. Connecting Parachute Riser Straps

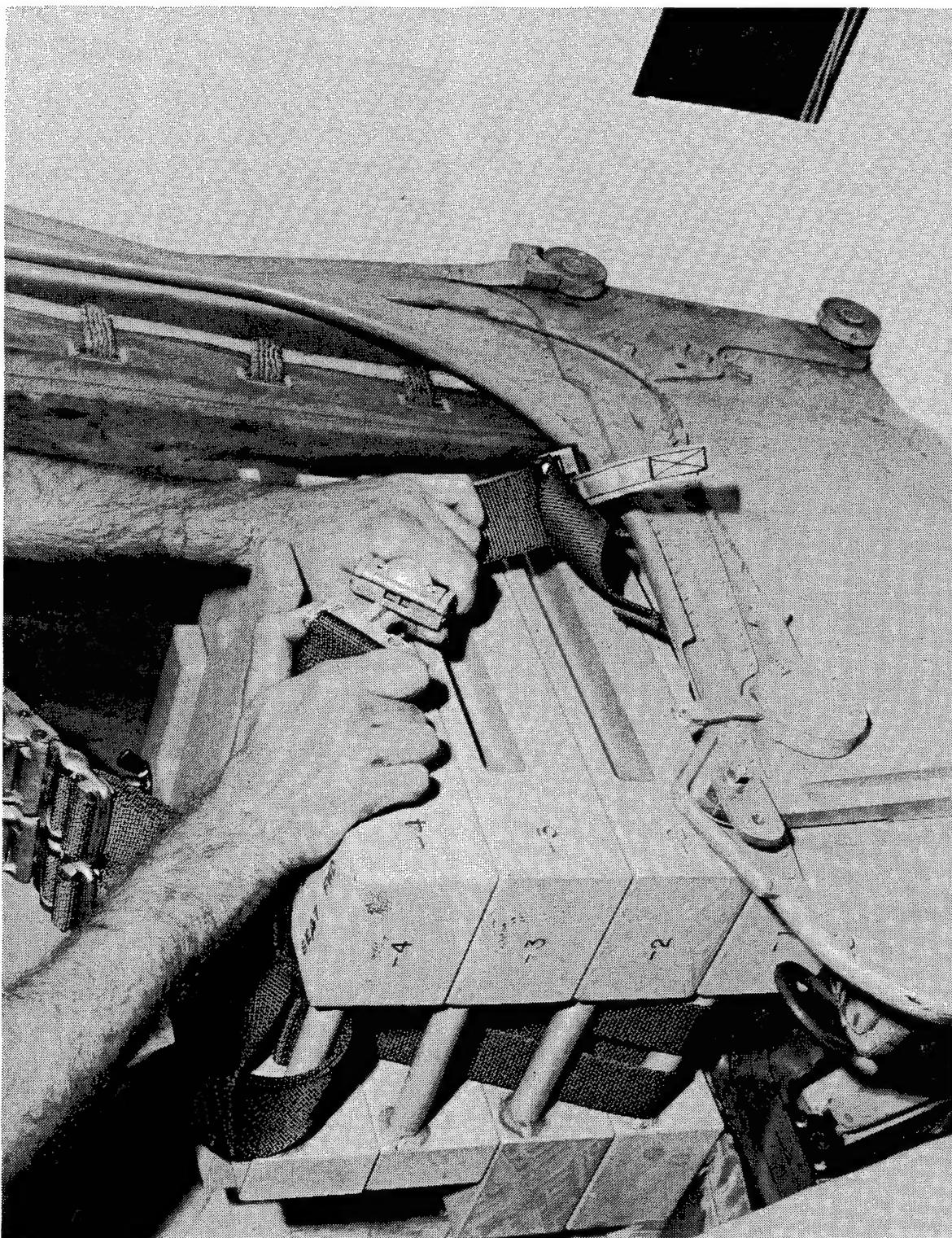


Figure 12. Connecting Lap Belt Fittings

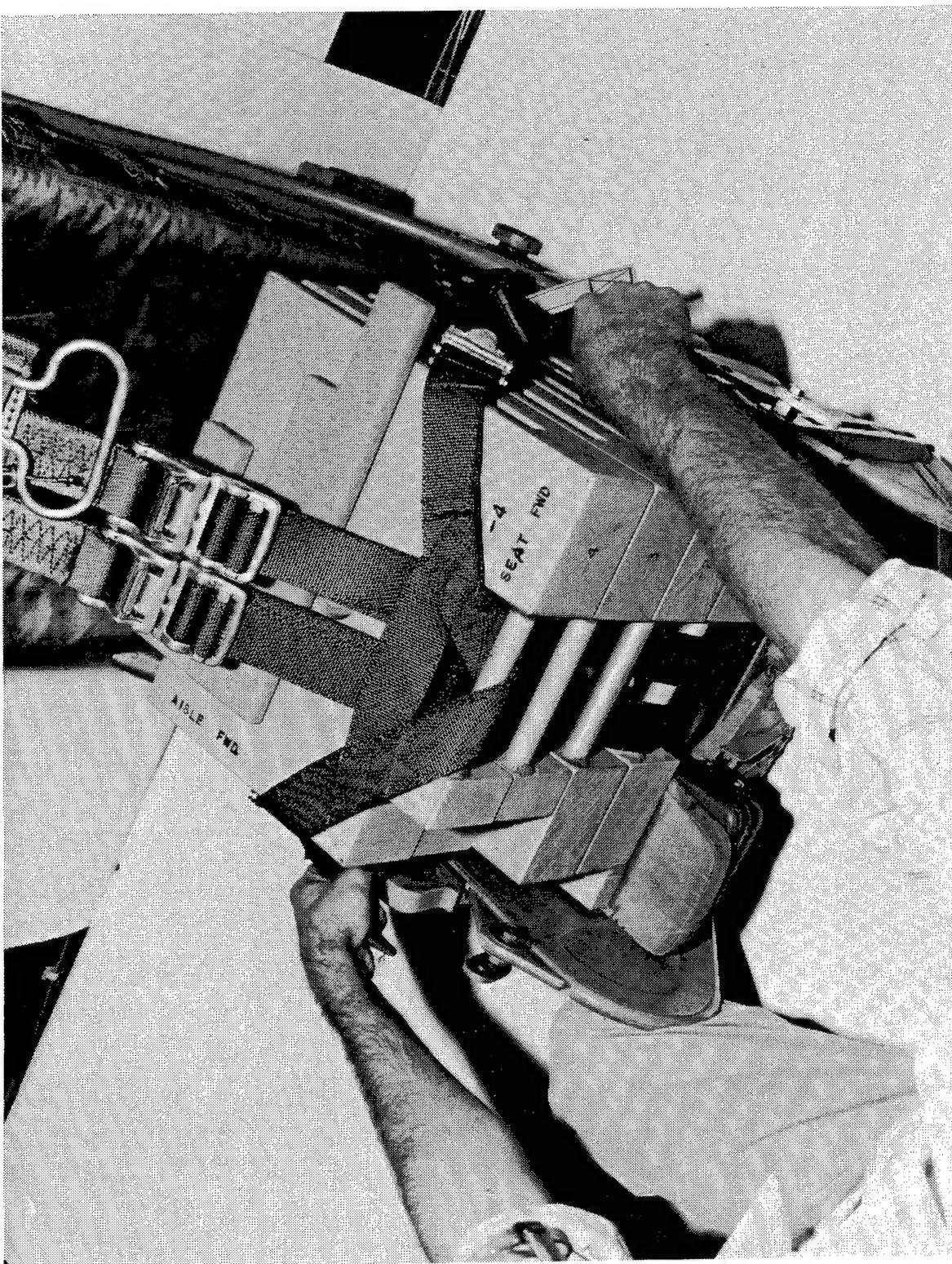


Figure 13. Tightening Straps on Seat

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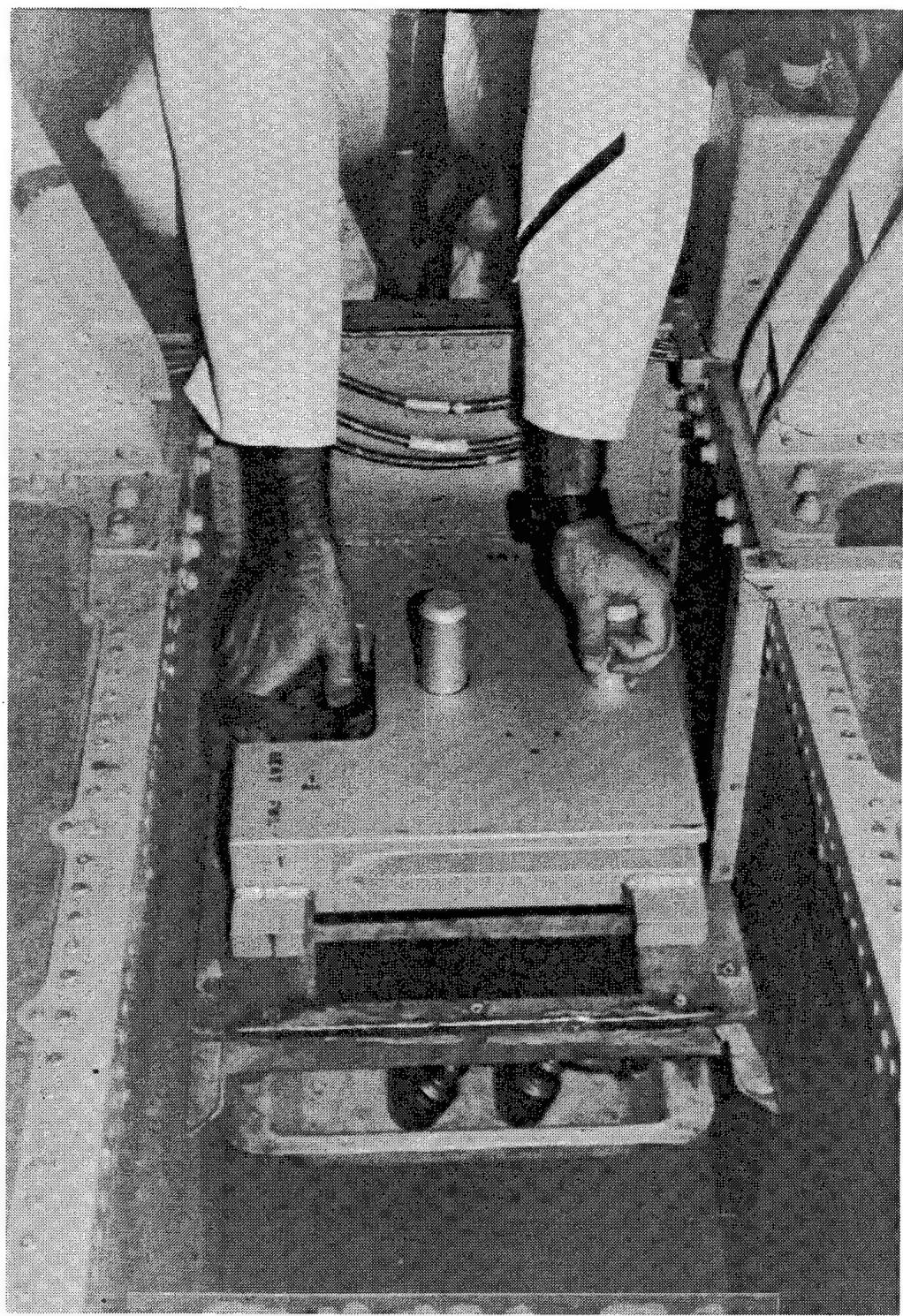


Figure 14. -1 Block on Aisle Step

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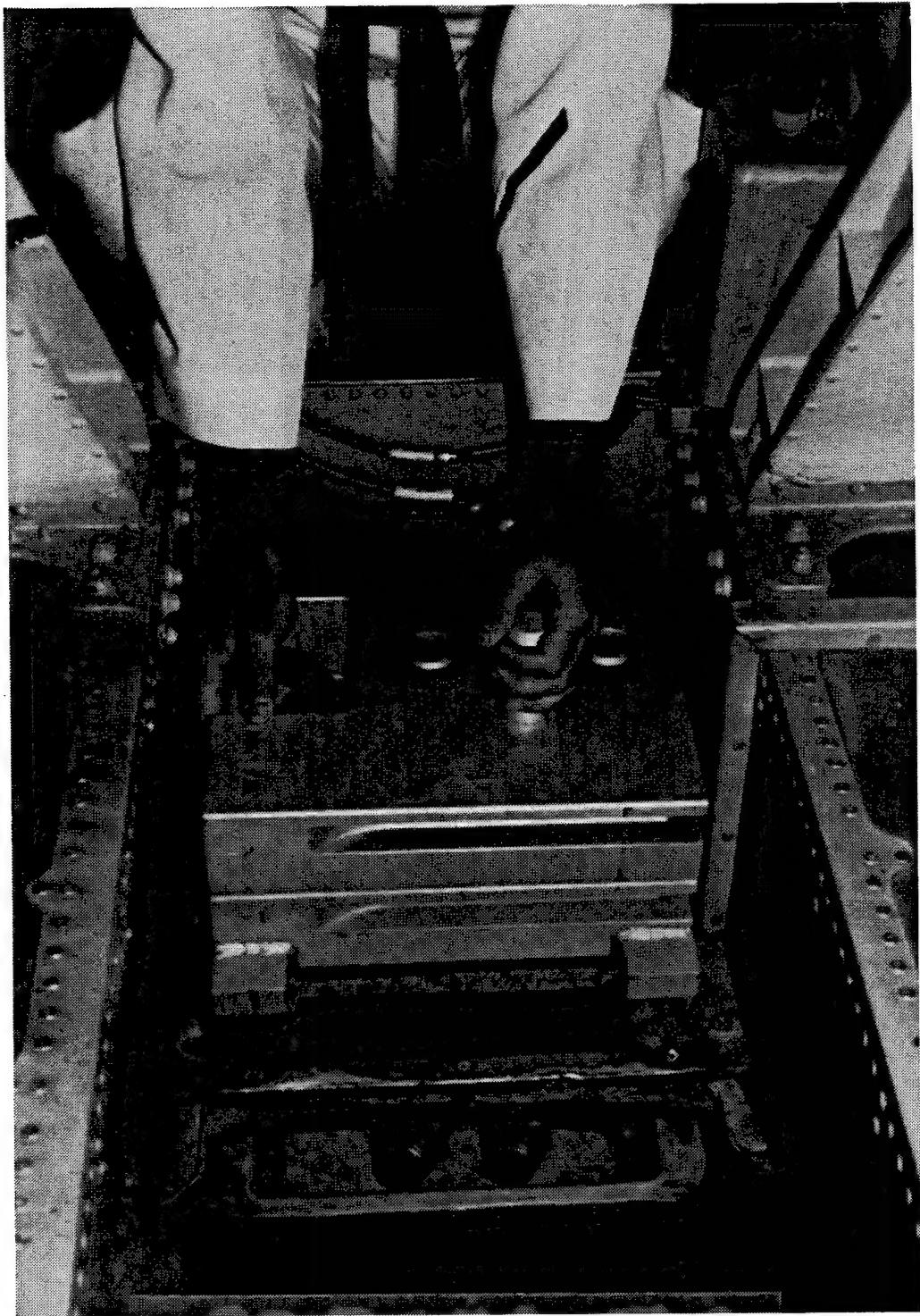


Figure 15. -2 Block on Aisle Step

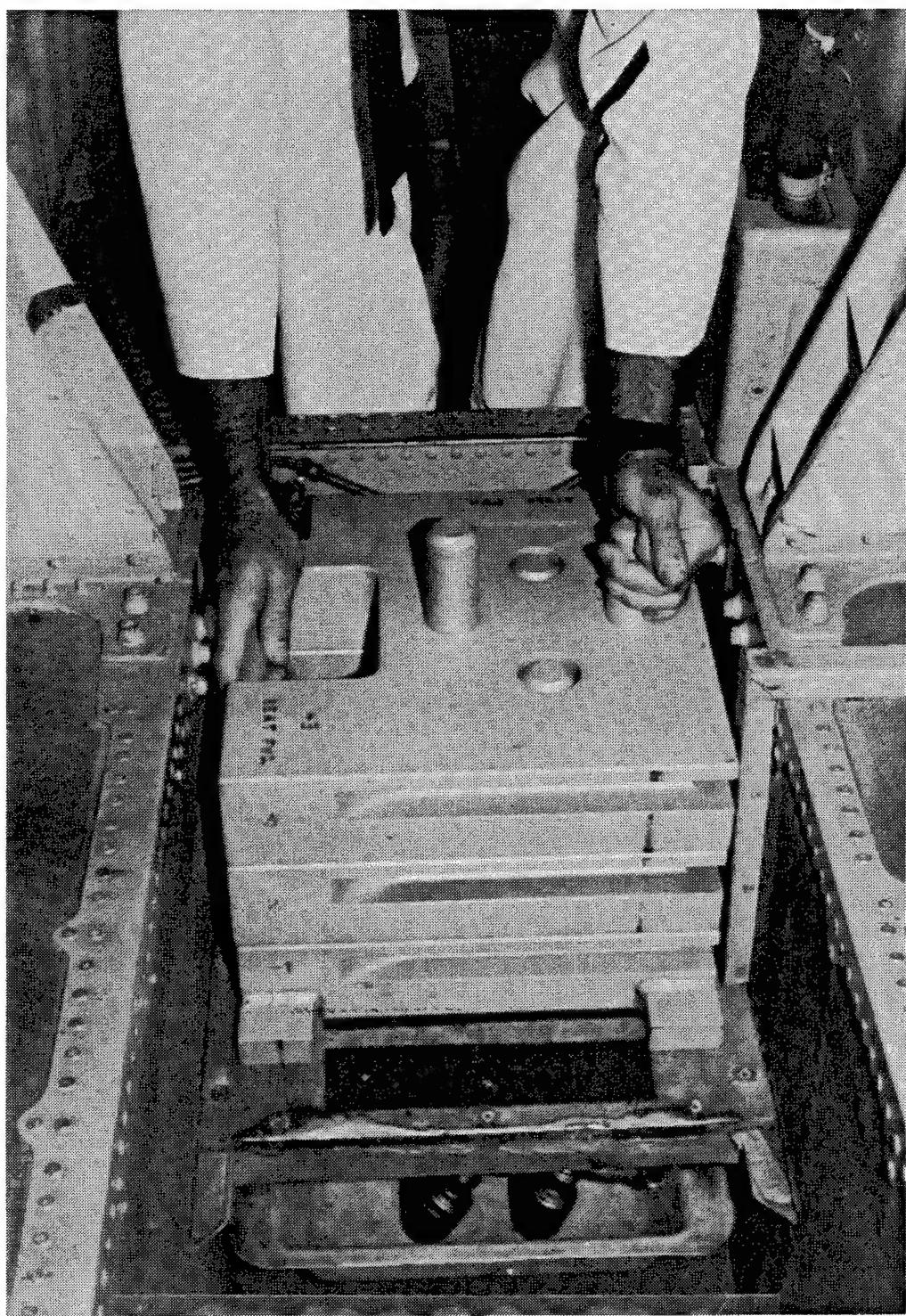


Figure 16. -3 Block on Aisle Step

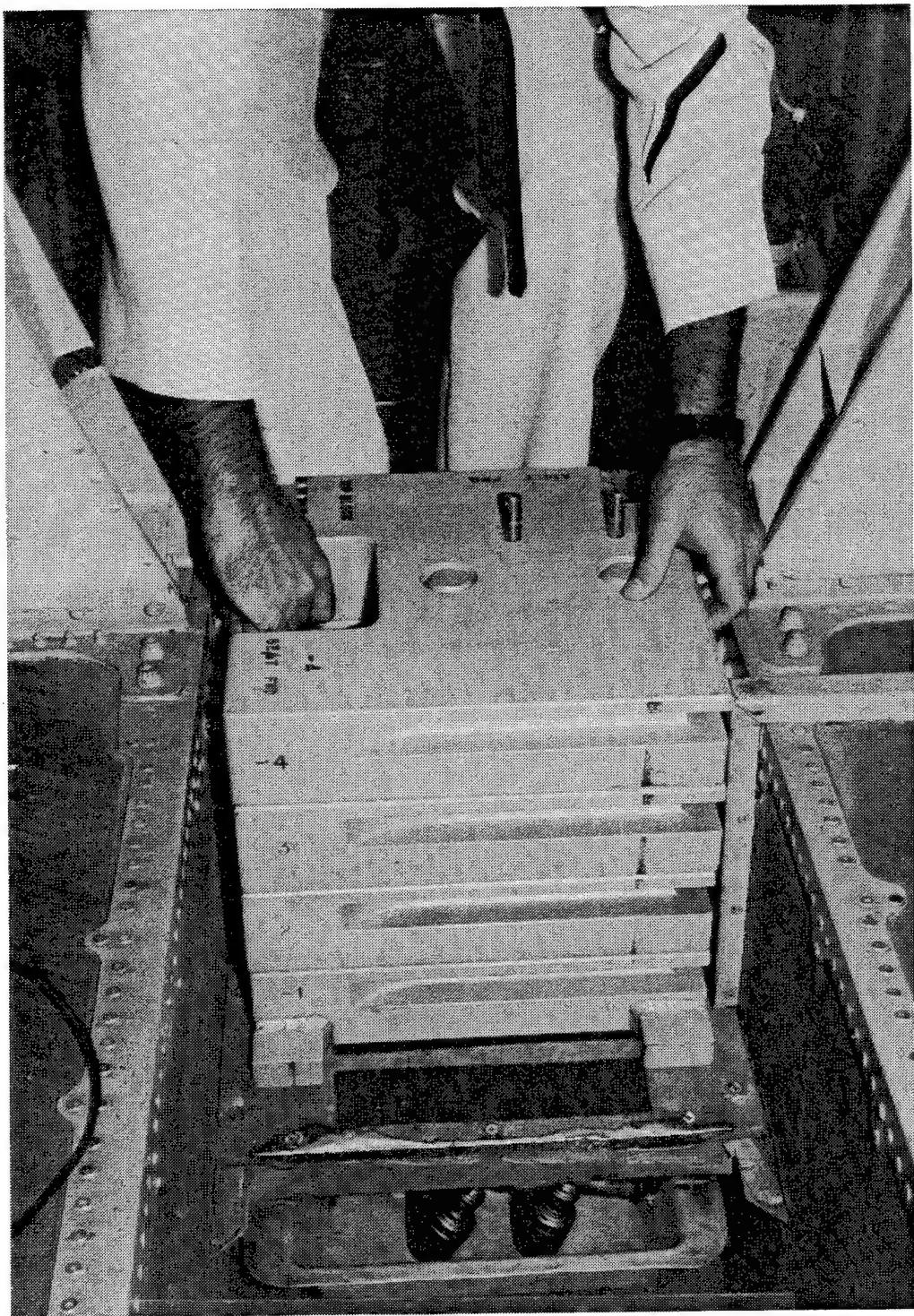


Figure 17. -4 Block on Aisle Step

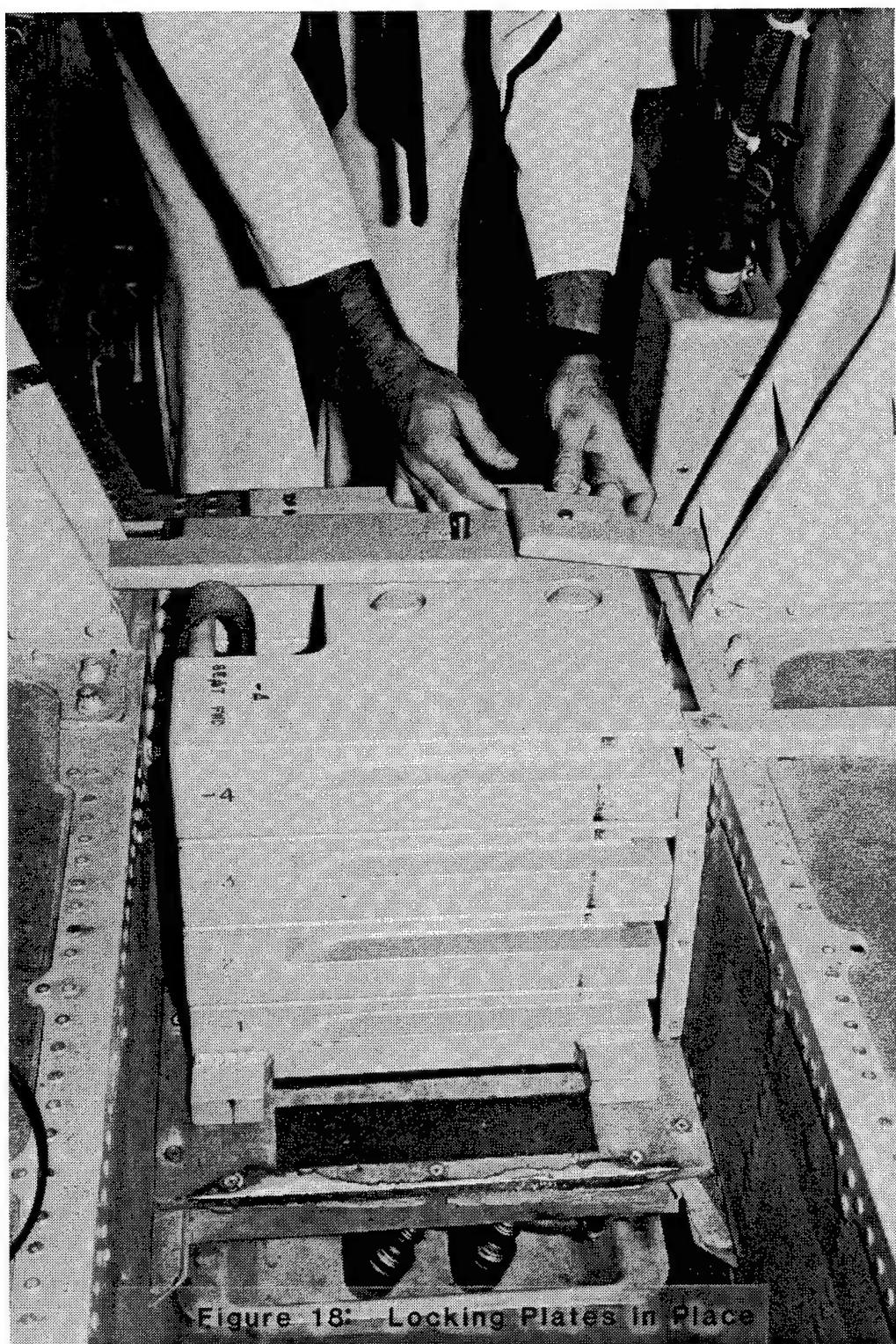


Figure 18: Locking Plates In Place

Figure 18. Lock Plates in Place

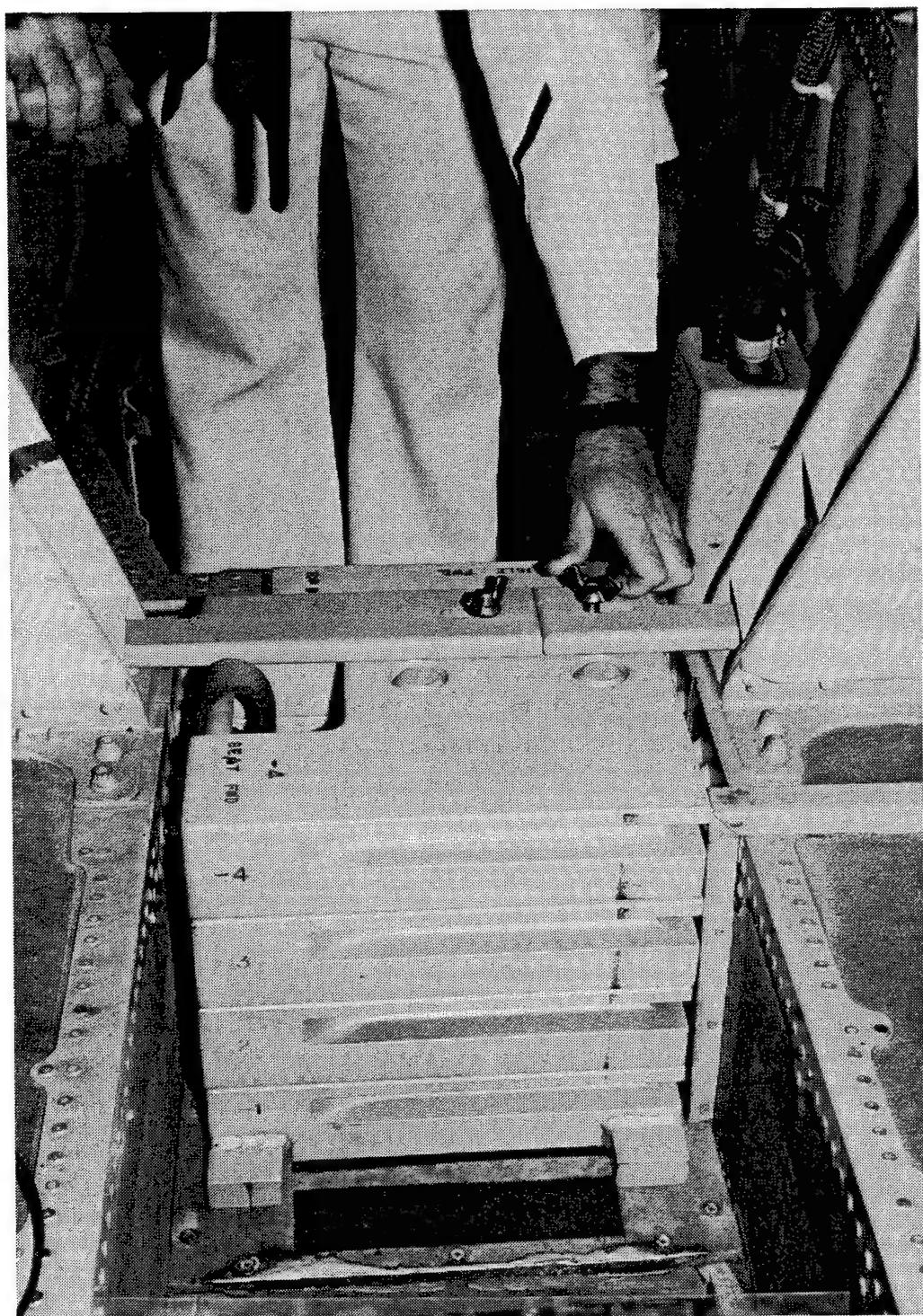


Figure 19. Wing Nuts on Locking Plates

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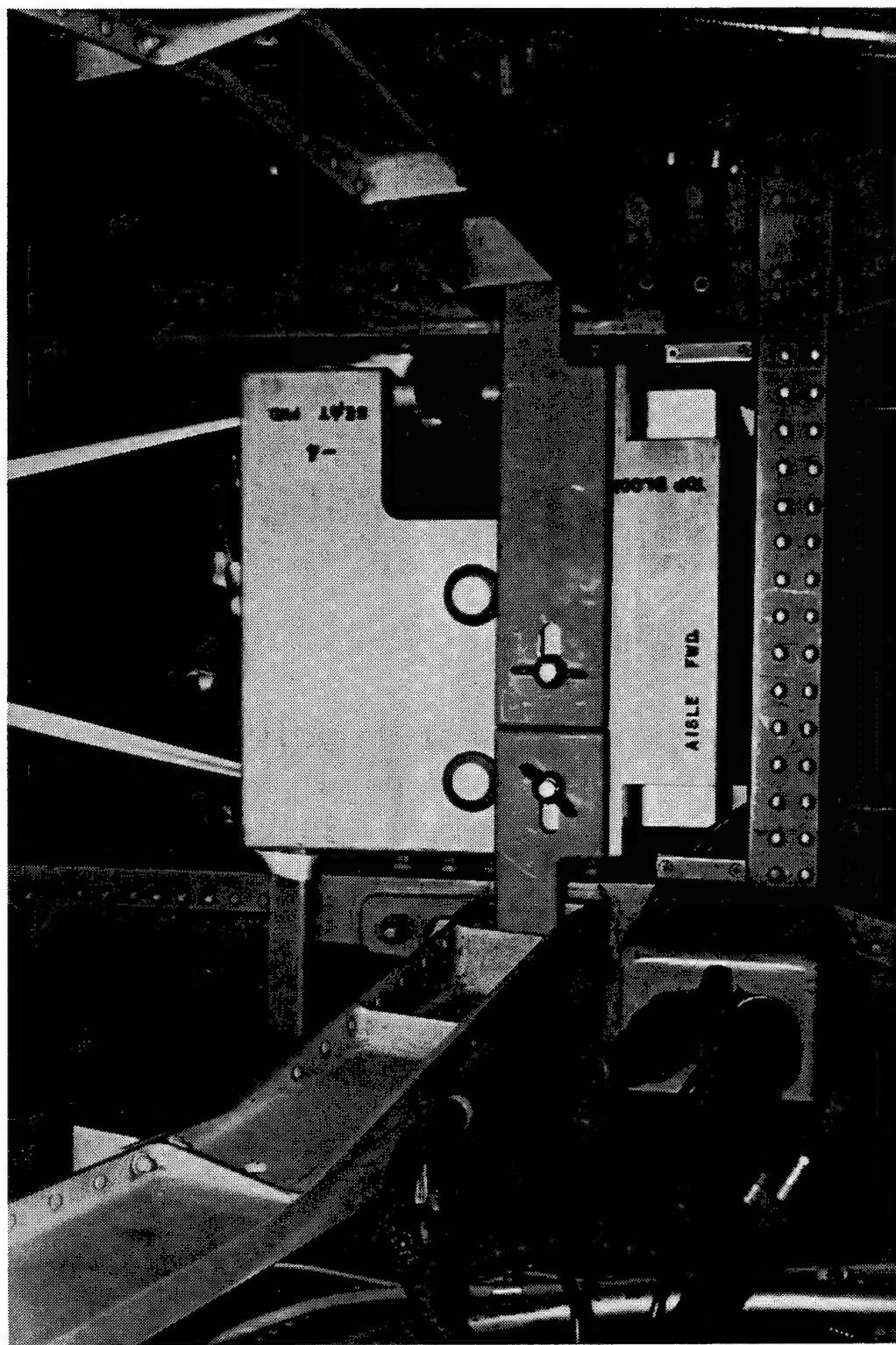
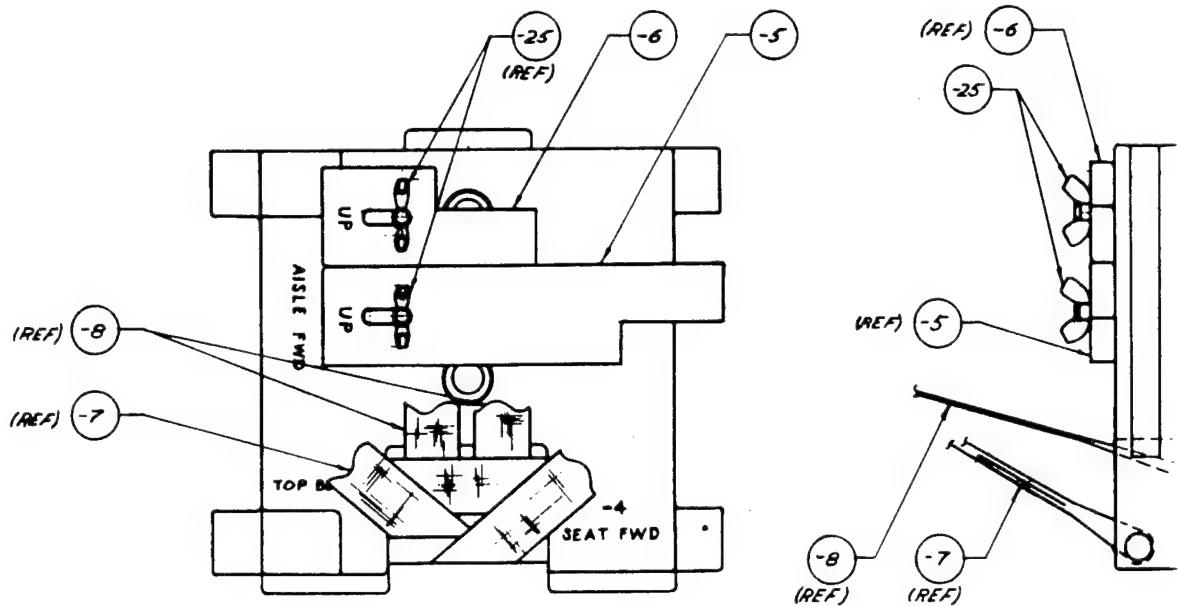
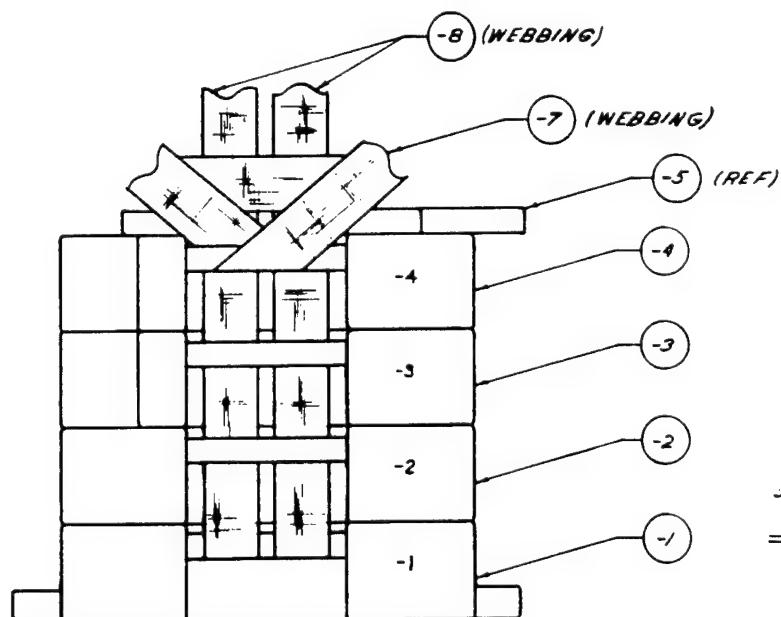


Figure 20. Top View of Assembly in Aisle

**D****C**

→

**A**

(1)

Figure

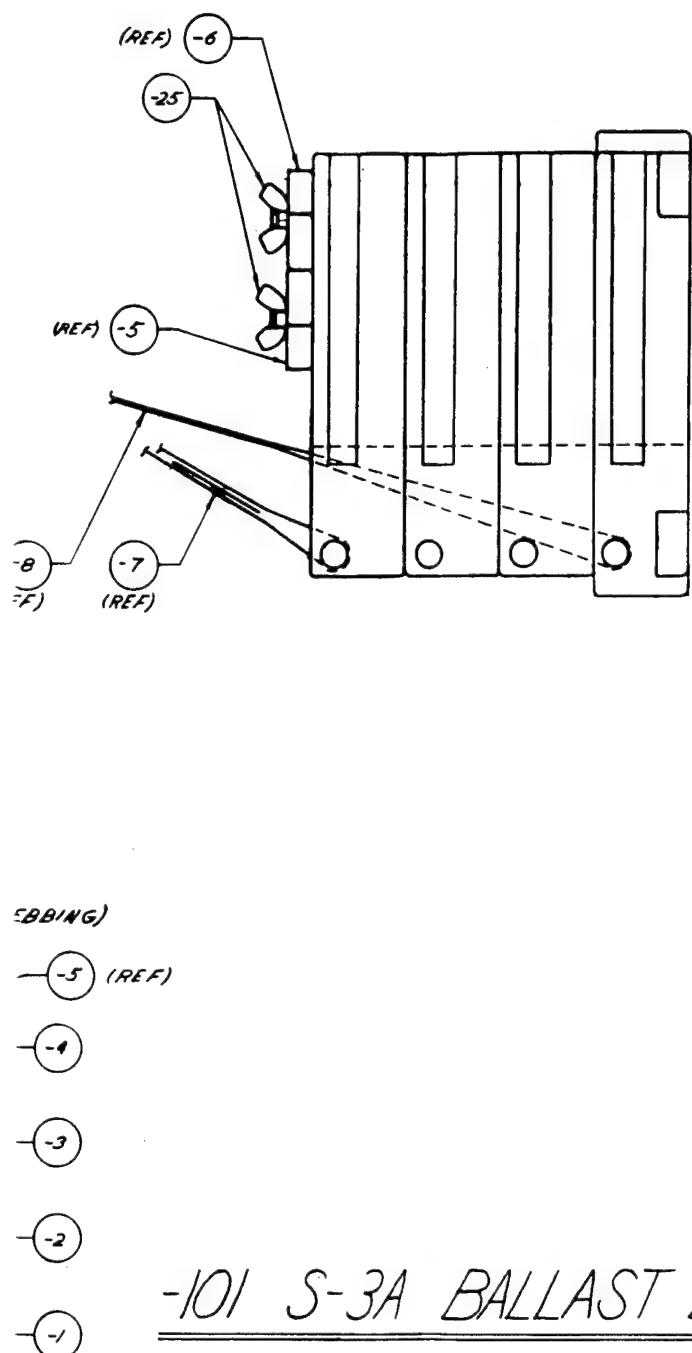


Figure 21. Dwg, S-3A Ballast Block, Assembly

2	-25	WING NUT	STEEL Cadmium
2	-24	BOLT	STEEL Cadmium
4	-22	TAB	6061- ALUM
4	-21	PLUG	
4	-20	HANDLE	
6	-19	POST	
1	-18	BLOCK	
1	-17	BLOCK	
1	-16	BLOCK	
1	-15	BLOCK	6061- ALUM
2	-14	SHOULDER HARNESS QUICK RELEASE FITNG	
2	-13	LAP BELT QUICK RELEASE FITTING	
AR	-12	THREAD	NYLON, 6 CAP
2	-11	STRAP	NYLON, WEBB.
1	-10	CROSS STRAP	
1	-9	STRAP	NYLON, WEBB.
2	-8	SHOULDER HARNESS STRAP ASSY.	
1	-7	LAP BELT STRAP ASSY.	
1	-6	LOCKING PLATE	6061- ALUMIN
1	-5	LOCKING PLATE	6061- ALUM.
1	-4	BLOCK ASSY.	
1	-3	BLOCK ASSY.	
1	-2	BLOCK ASSY.	
1	-1	BLOCK ASSY.	
X	-101	S-3A BALLAST BLOCK ASSY.	
NO. REQ'D	PART NO.	NAME OF PART	MATE

*LIST OF*

WELDING SPECIFICATIONS SQUARE HOLE AND TUBE NUMBER: FRAC HOLE: 8 ANGLES: 2 1 PLACE SEC HOLE: 2 1 PLACE SEC HOLE: 2		CONTRACT NO.
DO NOT SCALE THIS DRAWING MATERIAL:		DRAWN BY: J. QUARTUCCIO 4/20/03 CHECKED BY: J. Lorch 4/20/03  APPROVED  APPROVED

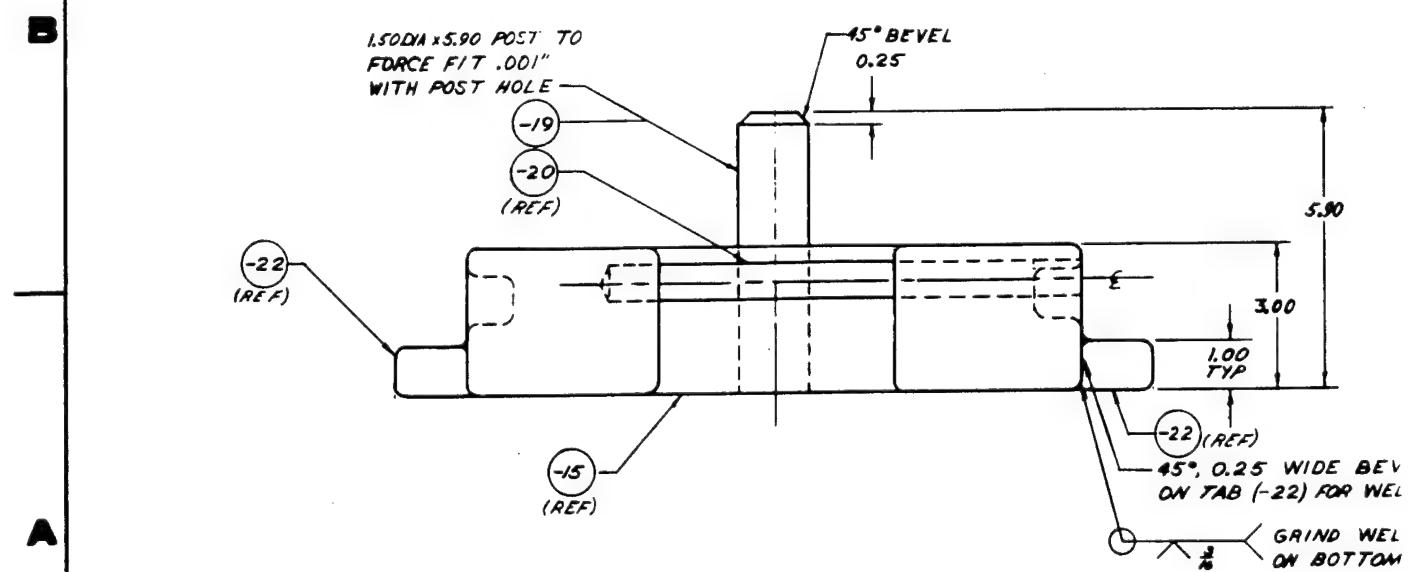
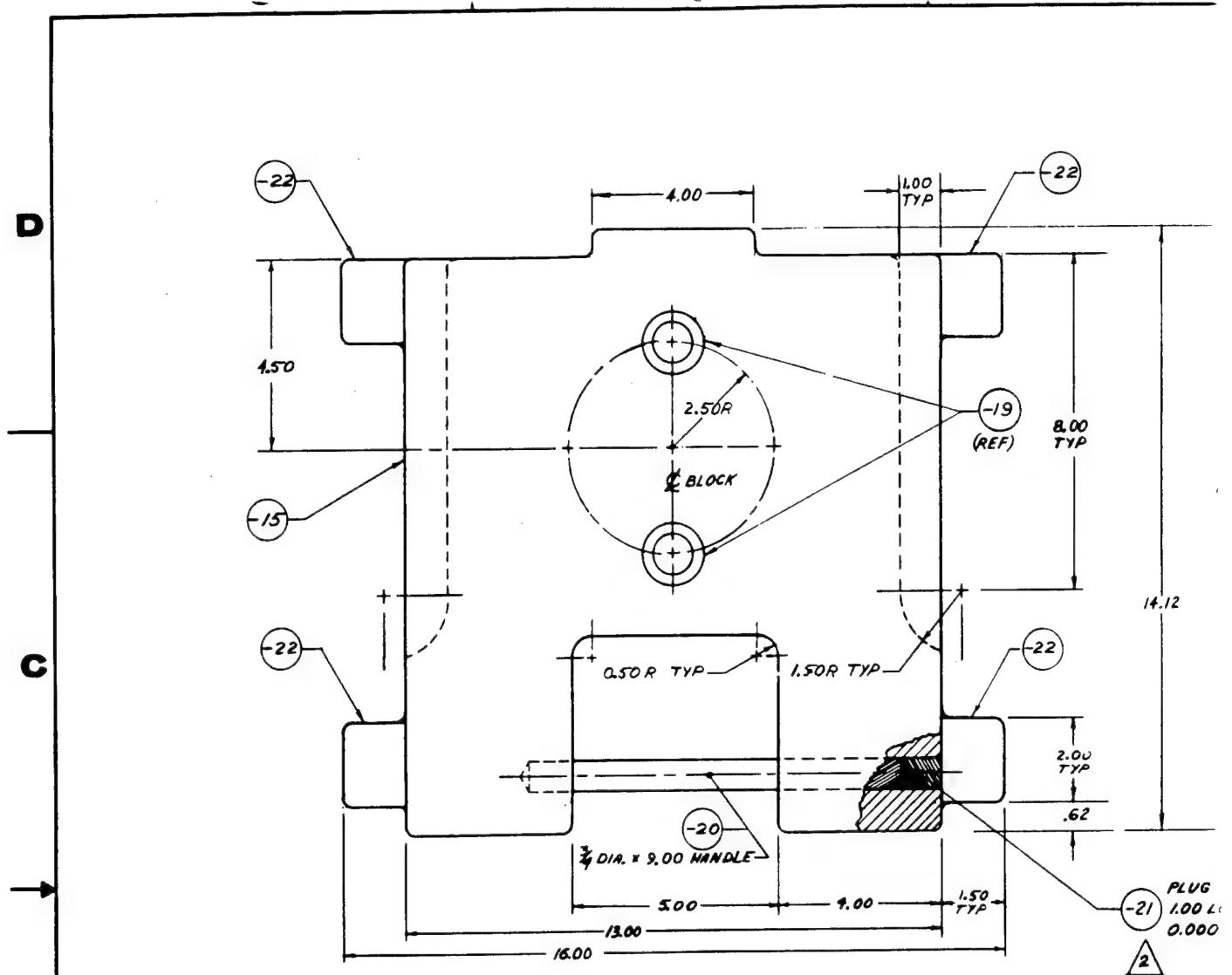
NADC-84015-60

			REVISIONS		
NO.	PART NO.	NAME OF PART	MATERIAL	SIZE	SPECIFICATION
2	-25	WING NUT	STEEL, CADMIUM PLATE	5/8 DIA	MS35426-1B
2	-24	BOLT	STEEL, CADMIUM PLATE	1/2 DIA, 3/4 GRIP	AN-B-35
4	-22	TAB	6061-T651 ALUMINUM	100x1.50x2.00	
4	-21	PLUG		13/16 DIA x 1.00	
4	-20	HANDLE		3/4 DIA x 9.00	
6	-19	POST		1.50 DIA x .5.90	
1	-18	BLOCK		3.00 x 18.00 x 8.00	
1	-17	BLOCK			
1	-16	BLOCK		3.00 x 13.00 x 13.00	
1	-15	BLOCK	6061-T651 ALUMINUM	3.00 x 18.00 x 14.12	
2	-14	SHOULDER HARNESS QUICK RELEASE FITNG			A/N 015-710001-1 (KOCH)
2	-13	LAP BELT QUICK RELEASE FITTING			A/N 015-11366-1 (KOCH)
AR	-12	THREAD	NYLON, SAGE GRN 6 CORD		V-T-285 NIIN 00-559-5211
2	-11	STRAP	NYLON, SAGE GRN WEBBING	1 3/4 x 54.0	MIL-W-4088 TY XIII
1	-10	CROSS STRAP		1 3/4 x 11.0	
1	-9	STRAP	NYLON, SAGE GRN WEBBING	1 3/4 x 44.0	MIL-W-4088 TY XIII
2	-8	SHOULDER HARNESS STRAP ASSY.			
1	-7	LAP BELT STRAP ASSY.			
1	-6	LOCKING PLATE	6061-T651 ALUMINUM	.75 x 3.00 x 6.75	
1	-5	LOCKING PLATE	6061-T651 ALUMINUM	.75 x 3.00 x 12.75	
1	-4	BLOCK ASSY.			
1	-3	BLOCK ASSY.			
1	-2	BLOCK ASSY.			
1	-1	BLOCK ASSY.			
X	-101	S-3A BALLAST BLOCK ASSY.			

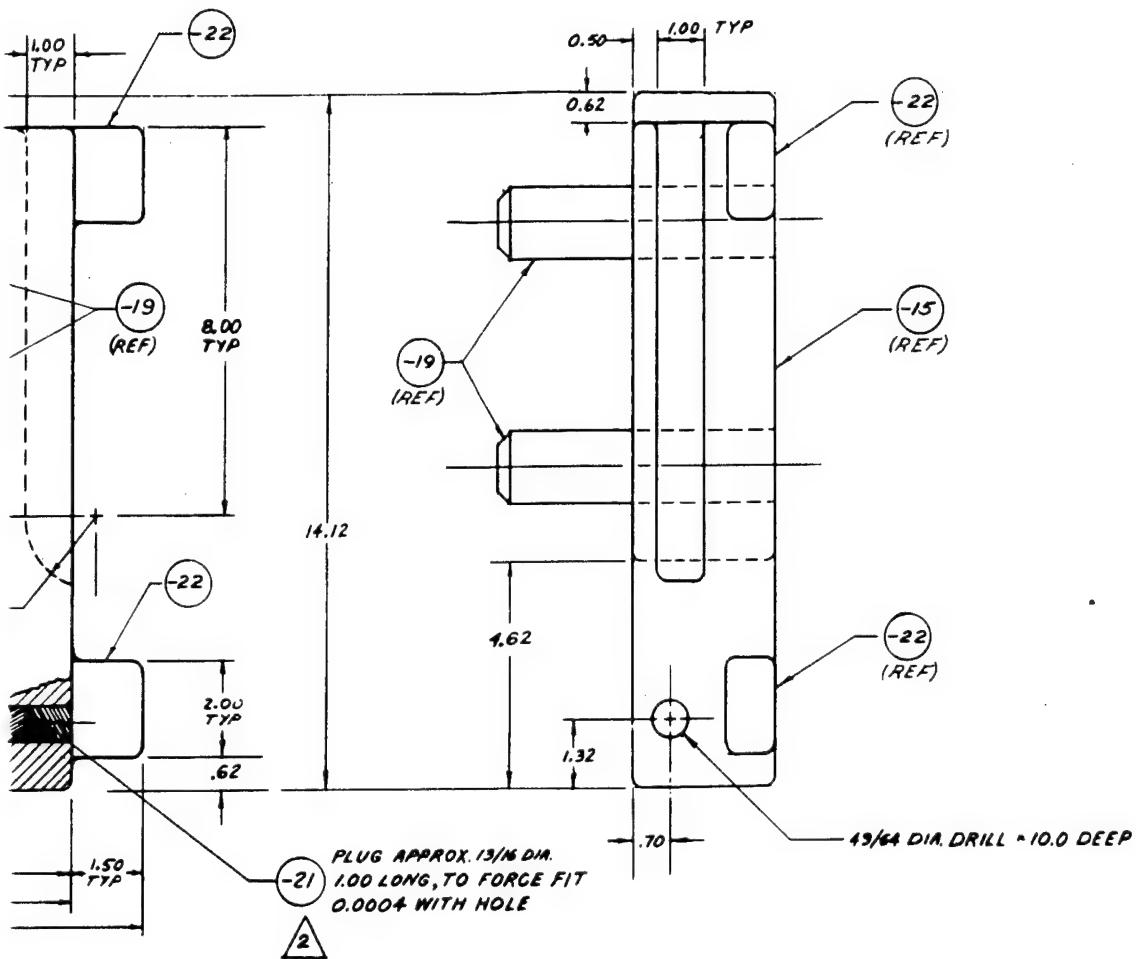
NO. REQ'D	PART NO.	NAME OF PART	MATERIAL	SIZE	SPECIFICATION
--------------	-------------	--------------	----------	------	---------------

## LIST OF MATERIALS

GENERAL INFORMATION, SPEC OF AND MANUFACTURER ARE IN REVERSE. MANUFACTURER AND: STRUCTURE: 2 ANGLES 2 PLATE SHEET WIRE 2 PLATE SHEET HOLE 2	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WILLIAMSTON, PA. 16774	
DO NOT SCALE THIS DRAWING	J. QUARTUCCO	M/10/83	
DATE:	J. Zouch	M/10/83	
APPROVED			
APPROVED			
S-3A BALLAST BLOCK ASSEMBLY		80206	S3ABB4/1
1/3		167/ASSY.	1 - 8



Figure



NOTES:

1. ALL EDGES AND CORNERS HAVE  $\frac{1}{8}$  R UNLESS OTHERWISE STATED.
2. ASSEMBLE TWO SHOULDER HARNESS STRAP ASSYS. (-8) AROUND HANDLE (-20) BEFORE FORCE FITTING PLUG (-21) INTO HOLE.
3. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

## -1 BLOCK ASSY.

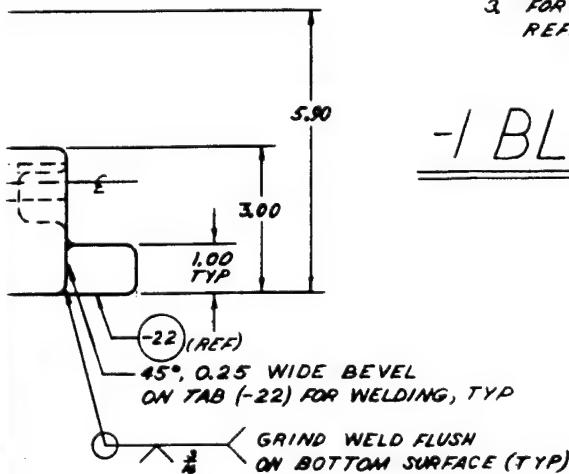


Figure 22. Dwg, S-3A Ballast Block, -1 Block

MAKING CHANGES HERE DOES NOT CHANGE PAPER SIZE OR NUMBER. TELETYPE AREA:		CONTRACT NO.
PRINTING 2 ANGLES 2 2 PLACE DECIMALS 2 1 PLACE DECIMALS 2 - 0V		
DO NOT SCALE THIS DRAWING		
MATERIAL:		
6061-T651 ALUMINUM		
FINISH: GRAY ANODIZE MIL-A-8625		
APPROVED		
APPROVED		

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
			APPROVED

0

—22  
(REF)

—15  
(REF)

—22  
(REF)

— 49/64 DIA. DRILL ~10.0 DEEP

AVE  
TEQ  
ARNESS  
D  
DE  
HOLE,  
DETAIL,

2Y  
=

PRINTED OTHERWISE SPEC'D IN DRAWING MADE IN INCHES. TOLERANCES AS:	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WILMINGTON, PA. 1974		
NOTES: 2 ANGLES 2 1 PLACE DECIMALS 2 1 PLACE DECIMALS 2 . OV				
DO NOT SCALE THIS DRAWING	1 QUARTER CCA 11/1000			
UNIVERSAL:	D. Xrod	S-3A BALLAST BLOCK -1 BLOCK		
6061-T651 ALUMINUM				
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED	DATE	DRAWN BY	REV.
		D 80206	S3ABB4/2	
	APPROVED	SCALE	WT	REVIS 2 OF 8
		1/2	WT	

Block

(3)

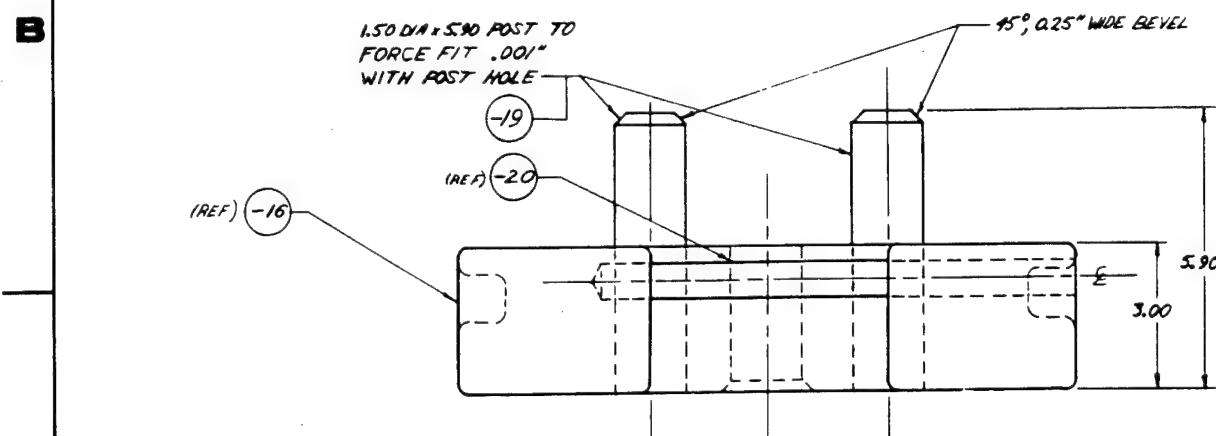
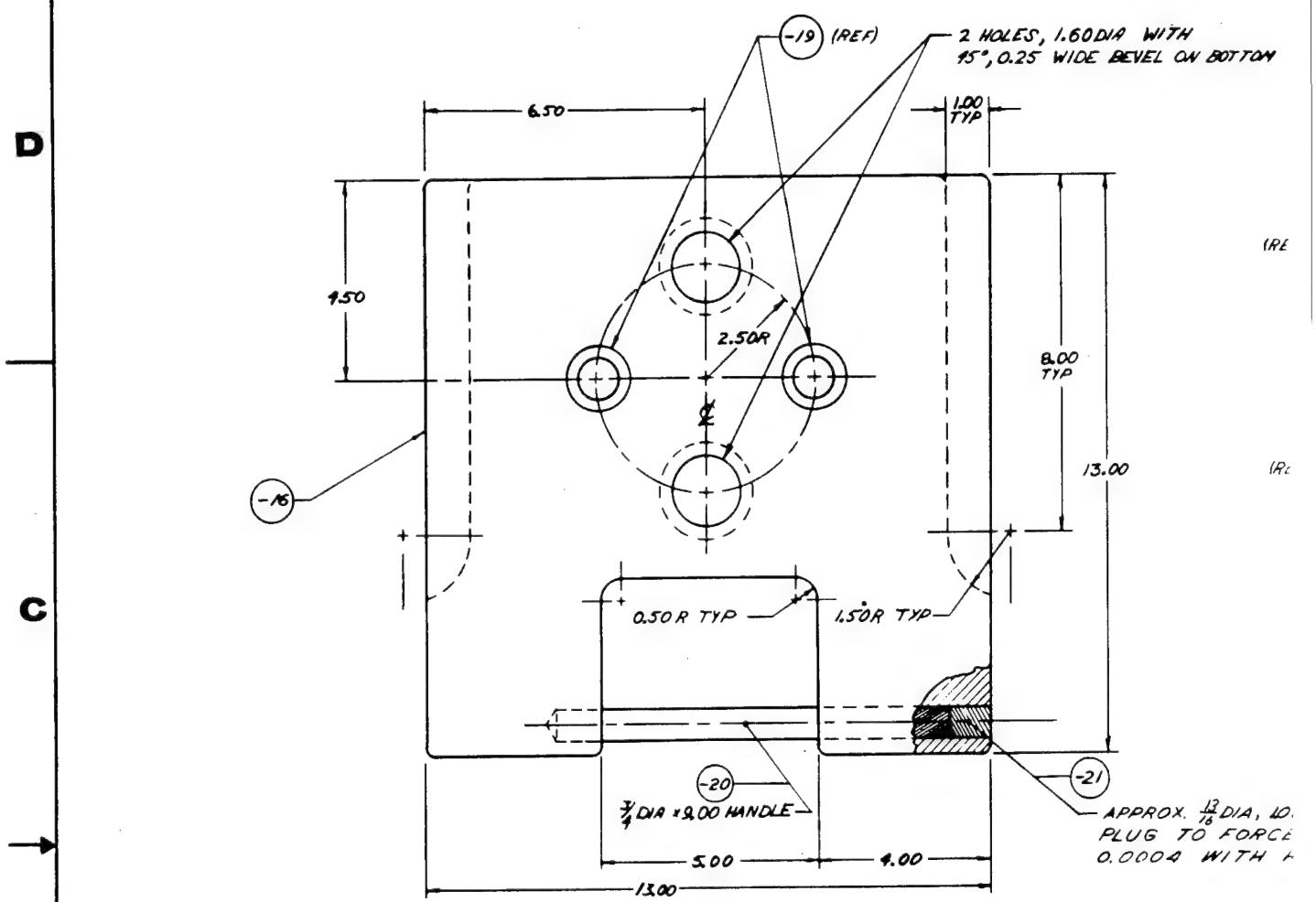
D

C

←

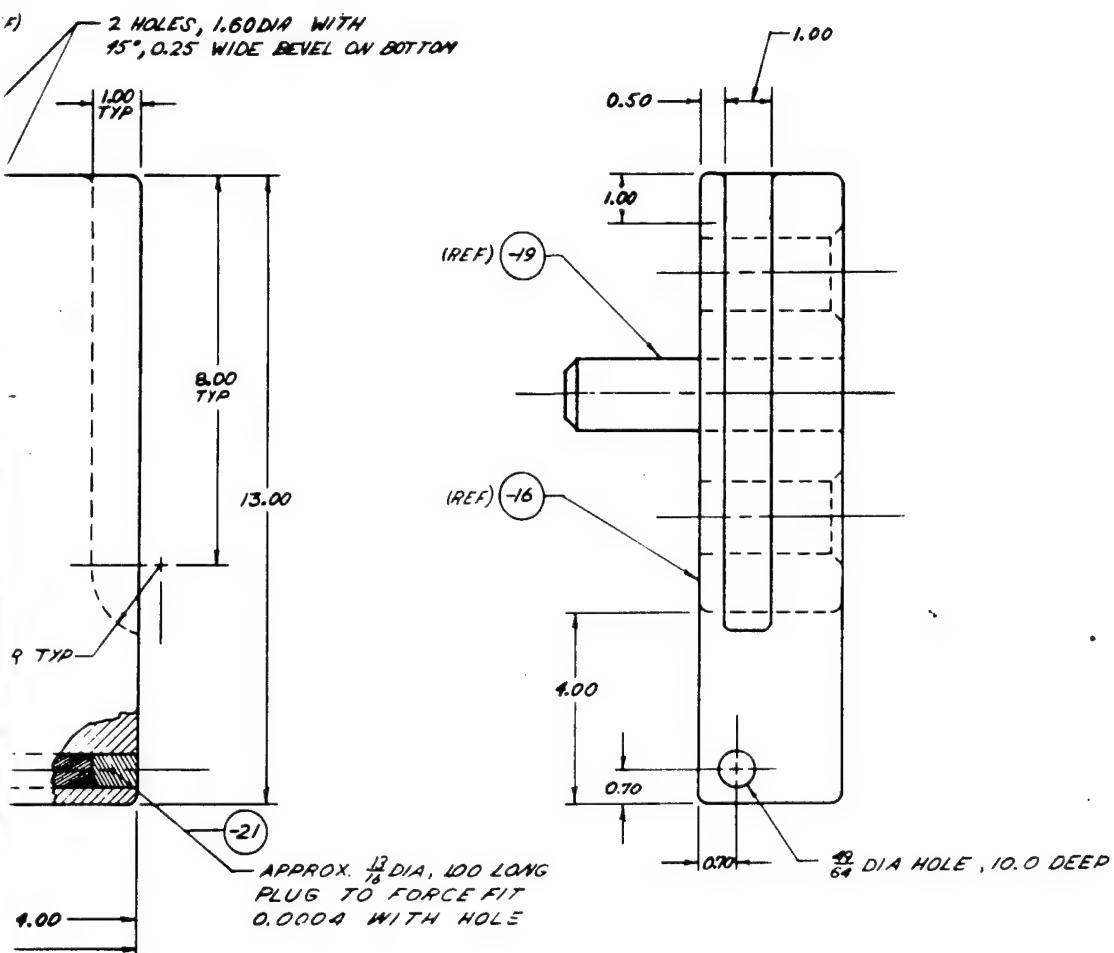
B

A



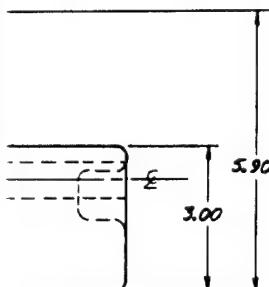
**A**

(1)



NOTES: 4. ALL EDGES AND CORNERS HAVE  
FR UNLESS OTHERWISE STATED.  
5. FOR CHARACTER STAMPING DETAIL,  
REFER TO SHEET 8.

— 15°, 0.25" WIDE BEVEL



-2 BLOCK ASSY.

Figure 23. Dwg, S-3A Ballast Block, -2 Block

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:	CONTRACT NO.
FRACTIONS ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± .01	ANGLES ± 0.20
DO NOT SCALE THIS DRAWING	DRAWN <input checked="" type="checkbox"/> J. QUAR
MATERIAL:	CHECKED <input checked="" type="checkbox"/> Q. ZO
6061-T651 ALUMINUM	
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED
	APPROVED

84015-60

REVISI0NS		DESCRIPTION	DATE	APPROVED
ZONE	LTR			

D

C

A

DIA HOLE, 10.0 DEEP

S HAVE  
STATED  
PING DETAIL,

SSY.

Block, -2 Block

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS $\pm \frac{1}{64}$ ANGLES $\pm 1^\circ$ 3 PLACE DECIMALS & 3 PLACE DECIMALS $\pm .01$		CONTRACT NO.		NAVAL AIR DEVELOPMENT CENTER WARRINGTON, PA. 18974		
DO NOT SCALE THIS DRAWING		DRAWN	QUARTUCCHI 11/20/85	53A BALLAST BLOCK -2 BLOCK		
MATERIAL:		CHECKED	Q. Zorich 11/20/85			
6061-T651 ALUMINUM						
FINISH: GRAY ANODIZE MIL-A-8625		APPROVED		SIZE	COMPONENT NO.	NABC DWS NO.
		APPROVED		D	80206	S3ABB4/3
		APPROVED		SCALE $\frac{1}{2}$	WT	Sheet 3 of 8

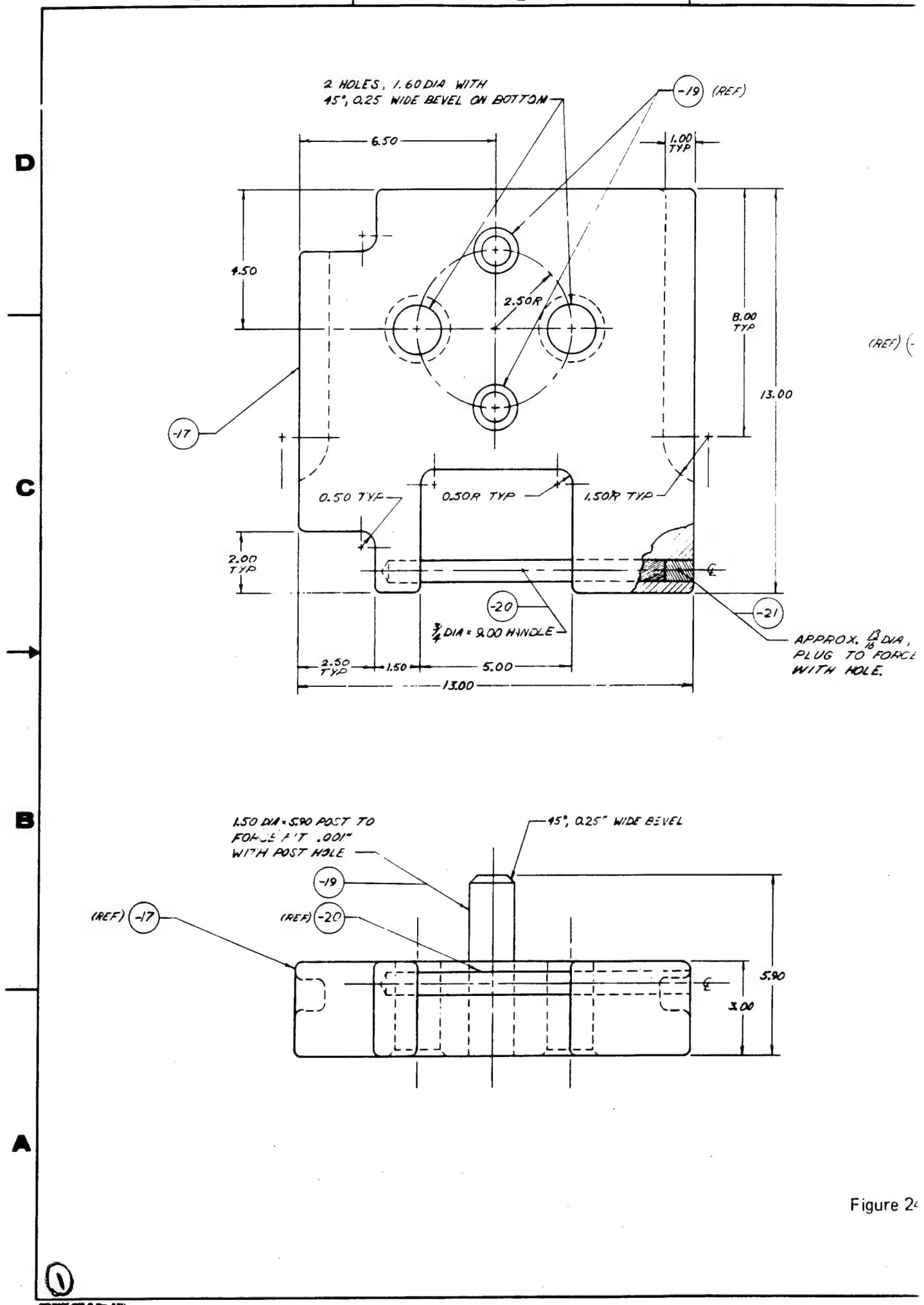
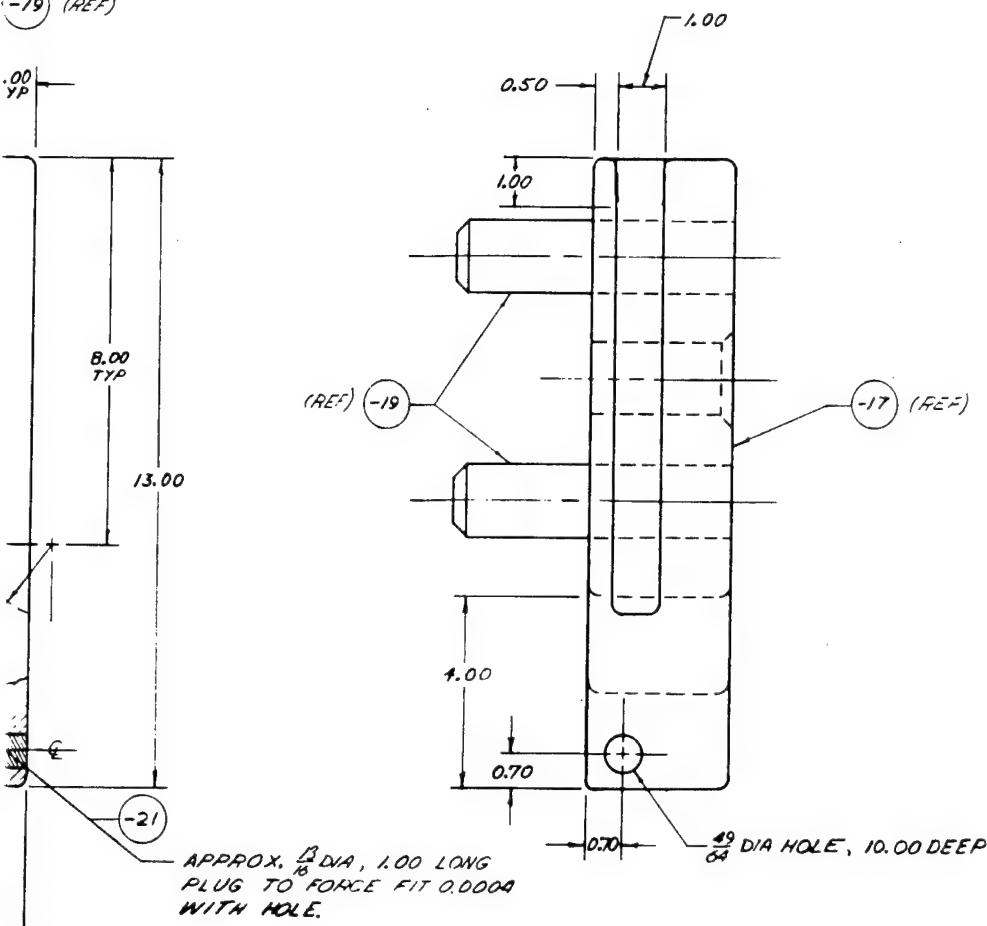


Figure 2<sup>c</sup>

-19 (REF)



NOTES: G ALL EDGES AND CORNERS HAVE  
1/4 R UNLESS OTHERWISE STATED.

7. FOR CHARACTER STAMPING DETAIL,  
REFER TO SHEET 8.

~~8~~ 3.00 5.90

-3 BLOCK ASSY.

Figure 24. Dwg, S-3A Ballast Block, -3 Block

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		CONTRACT NO.
FRACTIONS $\pm$ 3 PLACE DECIMALS $\pm$ 2 PLACE DECIMALS $\pm$	ANGLES $\pm$  $.01$	
<b>DO NOT SCALE THIS DRAWING</b>		DRAWN <u>WQUARTUSC10</u>
MATERIAL:  <u>6061-T651 ALUMINUM</u>		CHECKED <u>(+) S. rod</u> <u>11/2003</u>
FINISH:  <u>GRAY ANODIZE</u>  <u>MIL-A-8625</u>		APPROVED
		APPROVED

REVISIONS		DESCRIPTION	DATE	APPROVED
ZONE	LTR			

-17 (REV E)

, 10.00 DEEP

DETAIL,

UNLESS OTHERWISE SPEC'D IN DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONAL: <input checked="" type="checkbox"/> ANGLES: <input type="checkbox"/> <input type="checkbox"/> PLACE DECIMALS: <input type="checkbox"/> .01 <input type="checkbox"/> PLACE DECIMALS: <input type="checkbox"/> .01		CONTRACT NO.		NAVAL AIR DEVELOPMENT CENTER WILMINGTON, PA. 18974	
DO NOT SCALE THIS DRAWING		DRWNS	REQUOTED	S-3A BALLAST BLOCK -3 BLOCK	
MATERIAL: 6061-T651 ALUMINUM		CHNGD	C. Xed		
FINISH: GRAY ANODIZE MIL-A-8625		APPROVED		D	CHG'D BY NO. 80206 REV S3ABB4/4
		APPROVED		SCALE 1/2	WT
				DRAFT 4 - 8	

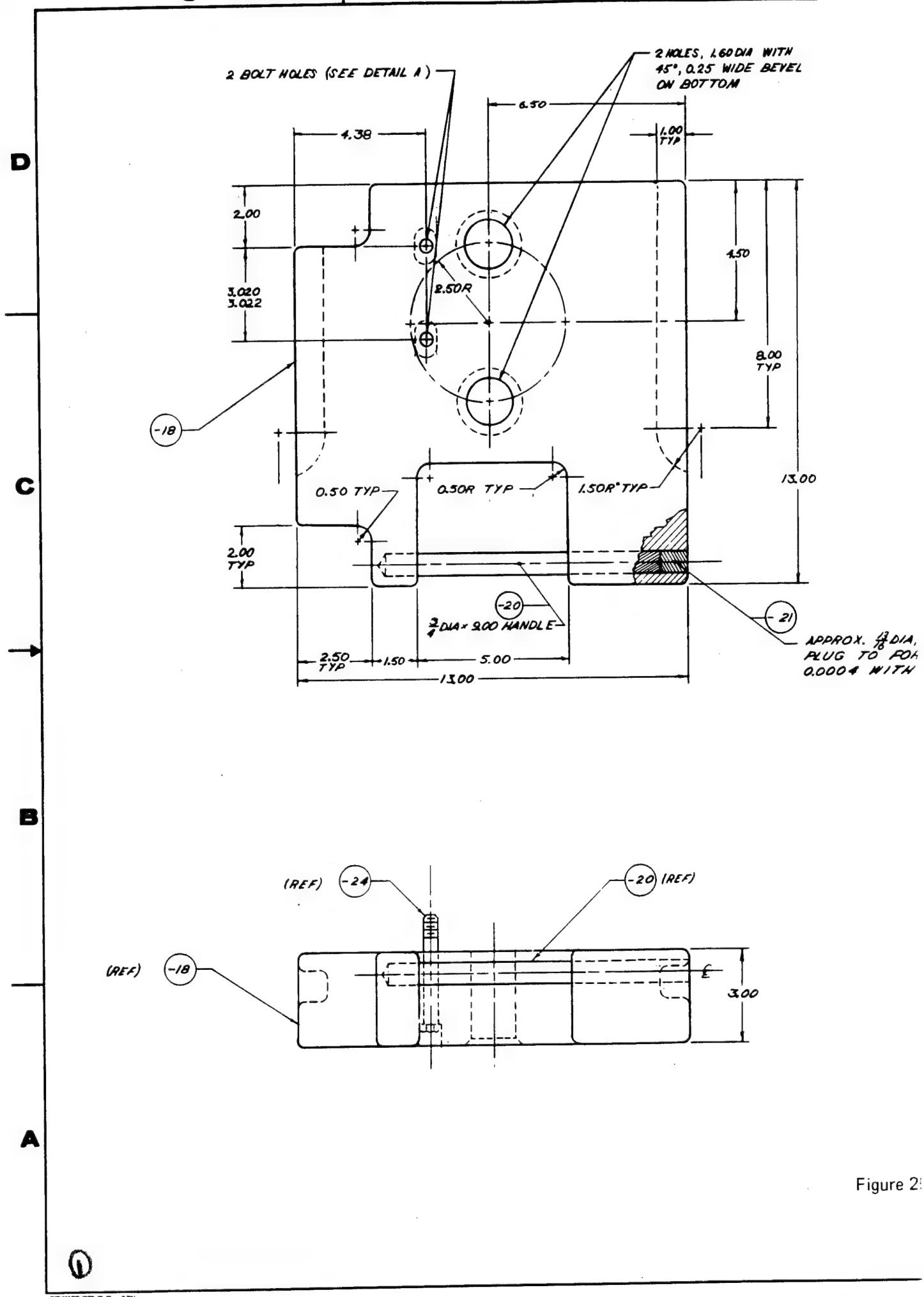
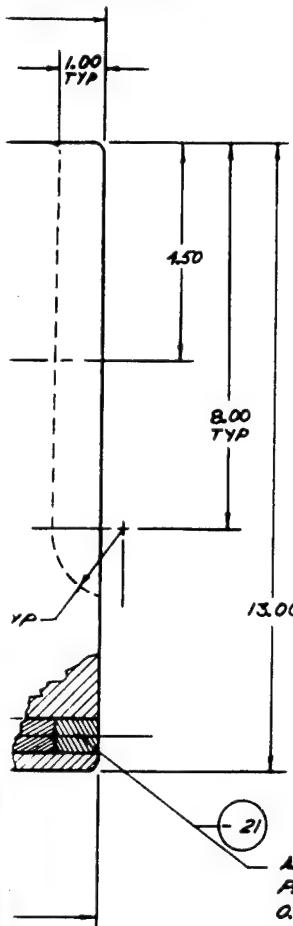


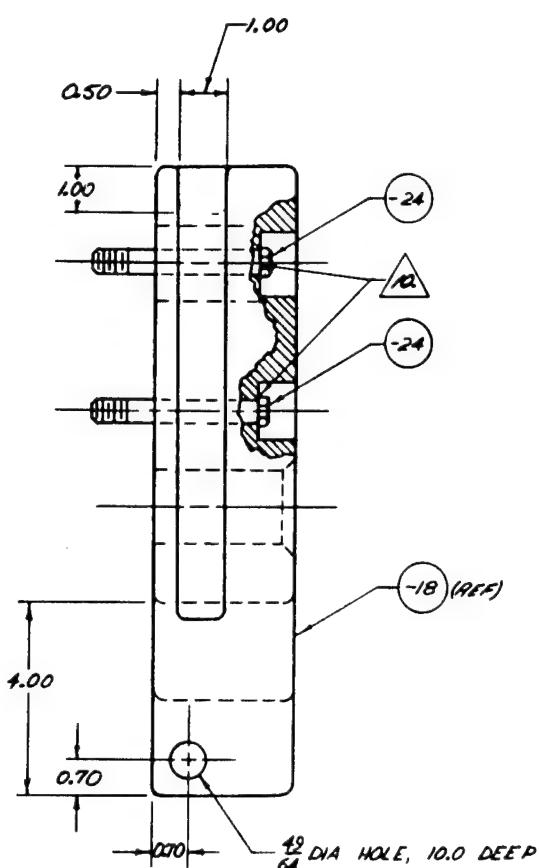
Figure 2<sup>1</sup>

NADC-84015-60

2 HOLES, 1.60 DIA WITH  
45°, 0.25 WIDE BEVEL  
ON BOTTOM



APPROX.  $\frac{3}{8}$  DIA, 1.00 LONG  
PLUG TO FORCE FIT  
0.0004 WITH HOLE. 9



COUNTERSINK DETAILS

DETAIL A: E

NOTES: & ALL EDGES AND CORNERS  
HAVE  $\frac{1}{8}$  R UNLESS OTHERWISE  
STATED.

② ASSEMBLE LAPBELL ASSY. (-7)  
AROUND HANDLE (-20) BEFORE  
FORCE FITTING PLUG (-21)  
INTO HOLE.

⑩ APPLY  $\frac{1}{2}$  IN. OF "LOCTITE" CEMENT BELOW  
BOLT HEAD BEFORE INSERTING BOLT.

11. FOR CHARACTER STAMPING DETAIL, REFER  
TO SHEET B.

② (REF)

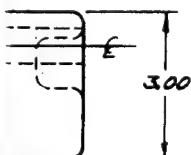
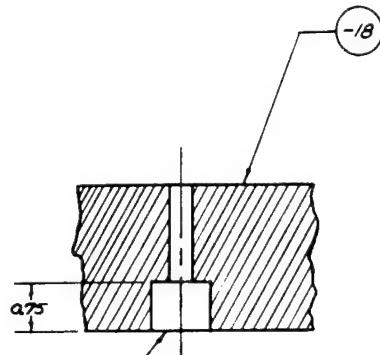
-4 BLOCK ASSY.

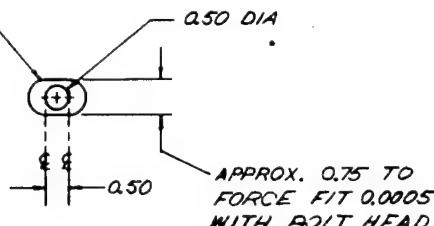
Figure 25. Dwg. S-3A Ballast Block, -4 Block

UNLESS OTHERWISE SPECIFIED 0 MEANS ZERO AND 10 MEANS TEN INCHES. TOLERANCES ARE: FRACTIONS $\pm \frac{1}{64}$ ANGLES $\pm 2^\circ$ 2 PLACE DECIMALS $\pm .0005$ 3 PLACE DECIMALS $\pm .001$	CONTRACT NO.
DO NOT SCALE THIS DRAWING	DRAWN <u>J. QUARTUCCI</u>
MATERIAL:	CHECKED <u>J. Quattucci</u>
6061-T651 ALUMINUM	
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED
	APPROVED

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
			APPROVED



COUNTERSINK DETAILS



### DETAIL A: BOLT HOLE

$\frac{1}{2}$  DIA HOLE, 10.0 DEEP

CORNERS:  
S OTHERWISE

LT ASSY (-7)  
-20) BEFORE  
PLUG (-21)

"LOCTITE" CEMENT BELOW  
ARE INSERTING BOLT.  
STAMPING DETAIL, REFER

ASSY.

-4 Block

(3)

DIMENS OTHER UNL. SPEC IF NED DIMENS IN INCHES ARE IN INCHES TOLERANCES ARE: FRACTIONS ± $\frac{1}{64}$ INCHES 2 2 PLACE DECIMALS ± .001 3 PLACE DECIMALS ± .001		CONTRACT NO.		NAVAL AIR DEVELOPMENT CENTER WARRINGTON, PA. 18974		
DO NOT SCALE THIS DRAWING	DRAWN <u>J. QUARTUCCIO</u>	CHECKED <u>D. Zanol</u>	11/28/83			
MATERIAL: <b>6061-T651 ALUMINUM</b>	APPROVED		S-3A BALLAST BLOCK -4 BLOCK			
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED	APPROVED	SPEC. NO.	COMP. NO.	MANUF. NO.	REV.
			<b>D</b>	<b>80206</b>	<b>S3ABB4/5</b>	
			SCALE $\frac{1}{2}$	WT	SHEET 5 OF 8	

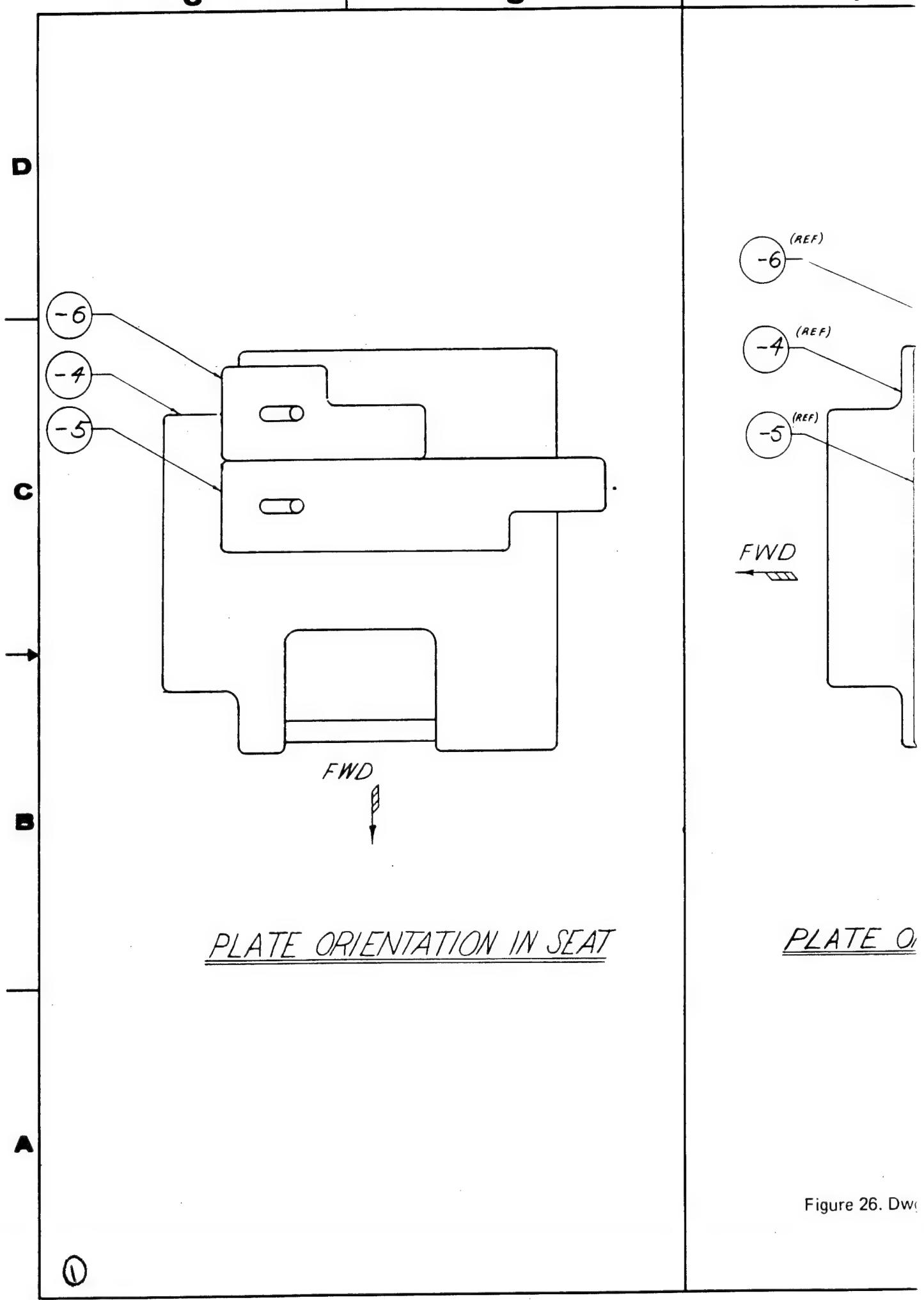
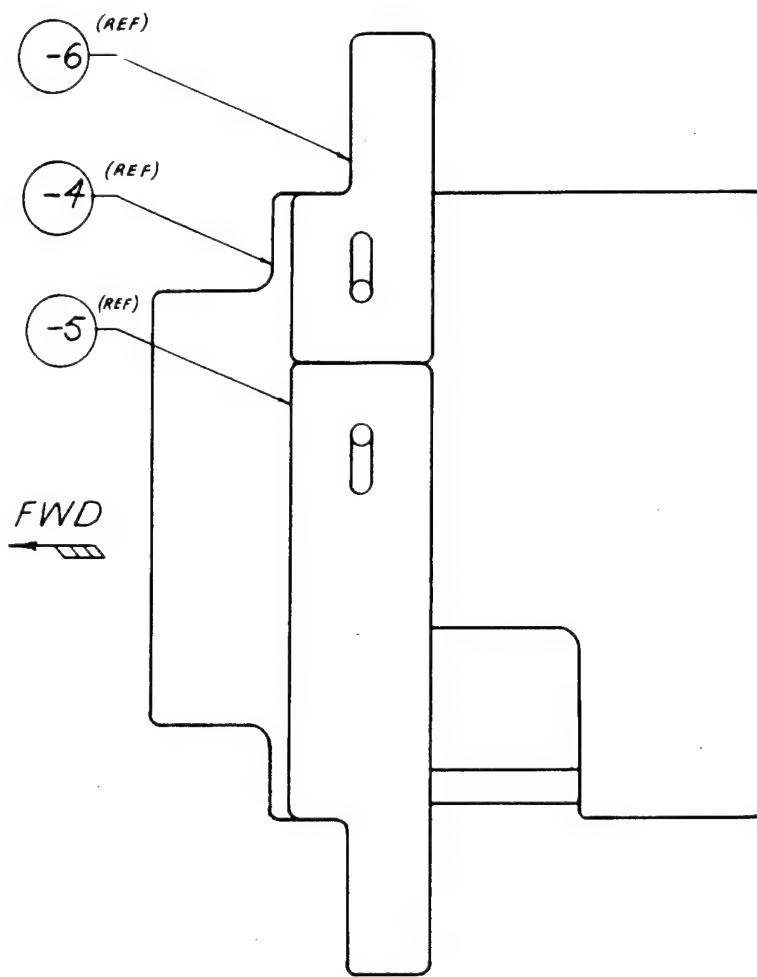


Figure 26. Dw



NOTES: 12. ALL OUTER C  
EDGES HAVE  
13. SLOT EDGES  
14. FOR CHARACTE  
REFER TO SHE

-5 LOCKIN

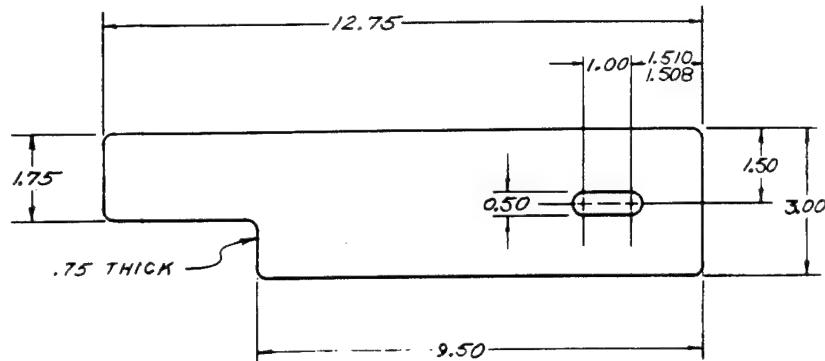
47  
NOTES: 15. ALL OUTER C  
EDGES HAVE  
16. SLOT EDGES  
17. FOR CHARACT  
REFER TO SH.

-6 LOCKIN

Figure 26. Dwg, S-3A Ballast Block, Aisle Locking Plate

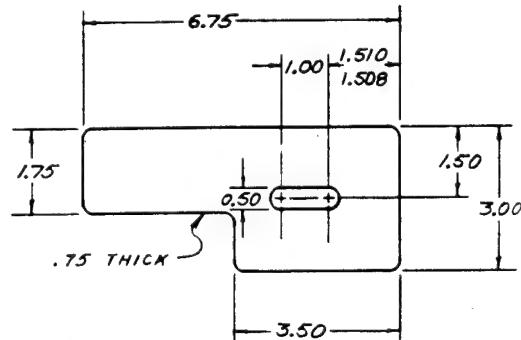
UNLESS OTHERWISE SPECIFIED TOLERANCES ARE .005 INCHES. TOLERANCES ARE .005 MM. FRAC INCH: ± .005 ANGLES: ± .005 2 PLACE DECIMALS & .00 3 PLACE DECIMALS & .000	CONTRACT NO.
DO NOT SCALE THIS DRAWING	SCALE
MATERIAL:	STAINLESS
6061-T651 ALUMINUM	FINISHED
FINISH:	GRAY ANODIZE
MIL-A-8636	APPROVED
	SUPERVISOR

		REVISIONS			
ZONE	LTR	DESCRIPTION		DATE	APPROVED



NOTES: 12. ALL OUTER CORNERS AND EDGES HAVE  $\frac{1}{4}$ R  
 13. SLOT EDGES HAVE  $\frac{1}{16}$ R  
 14. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

### -5 LOCKING PLATE DETAIL



NOTES: 15. ALL OUTER CORNERS AND EDGES HAVE  $\frac{1}{4}$ R  
 16. SLOT EDGES HAVE  $\frac{1}{16}$ R  
 17. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

AISLEWAY

### -6 LOCKING PLATE DETAIL

WEIGHT APPROXIMATE SPEC'D IN POUNDS PER SQ IN. TOLERANCES ARE: LENGTH +/- .005, ANGLES +/- .005, 2 PLACE DECIMALS & .005, 1 PLACE DECIMALS & .005	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WILMINGTON, DE 19874	
DO NOT SCALE THIS DRAWING	DRAWN BY QUARTUCCIA	A	
INSTRUMENT	checked	S-3A BALLAST BLOCK	
6061-T651 ALUMINUM	DESIGNED BY	AISLE LOCKING PLATES	
FINISH:	APPROVED	S-3ABB4/6	
GRAY ANODIZE	SUPERVISOR	SCALE 1/2	
MIL-A-8635	INITIALS	WT	REV 6 - 8

Locking Plate

(3)

**NOTES:**

19. MATERIALS (REPEATED FROM SHEET 1):

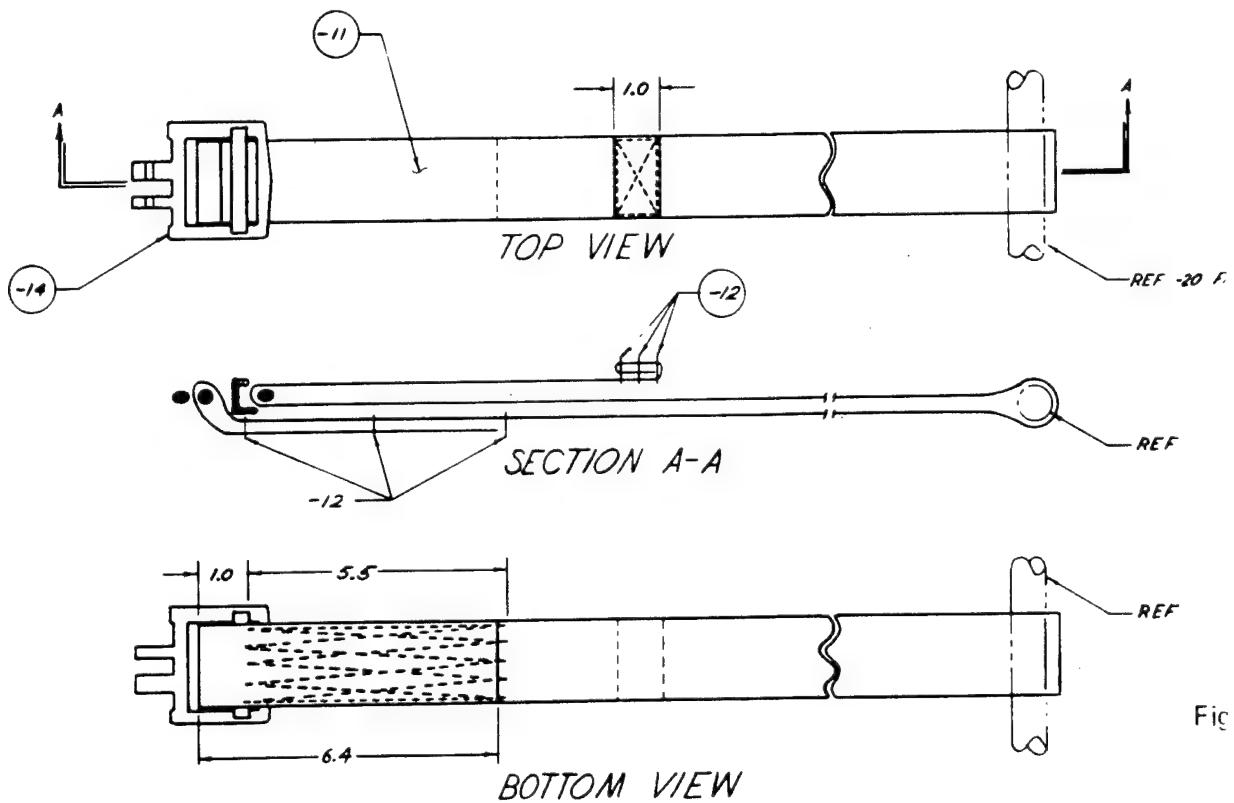
PART NO	NO. REQD PER ASSY.	DESCRIPTION	SIZE	MATERIAL	SPECIFICATION
-9	1	LAP BELT STRAP - ONE CONTINUOUS STRAP, LOOPED BACK ON ITSELF	$1\frac{3}{4} \times 44$	NYLON, SAGE GRN WEBBING	MIL-W-4088 TY XII
-10	1	CROSS STRAP	$1\frac{3}{4} \times 11$	" "	" "
-11	2	SHOULDER HARNESS STRAP	$1\frac{3}{4} \times 54$	" "	" "
-12	AS REQUIRED	THREAD		NYLON SAGE GRN, 6 CORD	V-T-295 NIIN 00-559-5211
-13	2	LAP BELT QUICK RELEASE FITTING			P/N 015-11366-1 (NOCH)
-14	2	SHOULDER HARNESS QUICK RELEASE FITTING			P/N 015-710001-1 (NOCH)

20. SEAR ENDS OF NYLON WEBBING TO PREVENT FRAYING, AVOID FORMING SHARP EDGES.

21. ALL STITCHING SHALL BE 4 TO 6 THREADS PER INCH.

22. STITCHING ALONG EDGE SHALL BE  $\frac{1}{8}$  IN. AWAY FROM EDGE OF WEBBING.

23. ALL STITCHING SHALL BE BACKSTITCH  $\frac{1}{2}$  MIN.



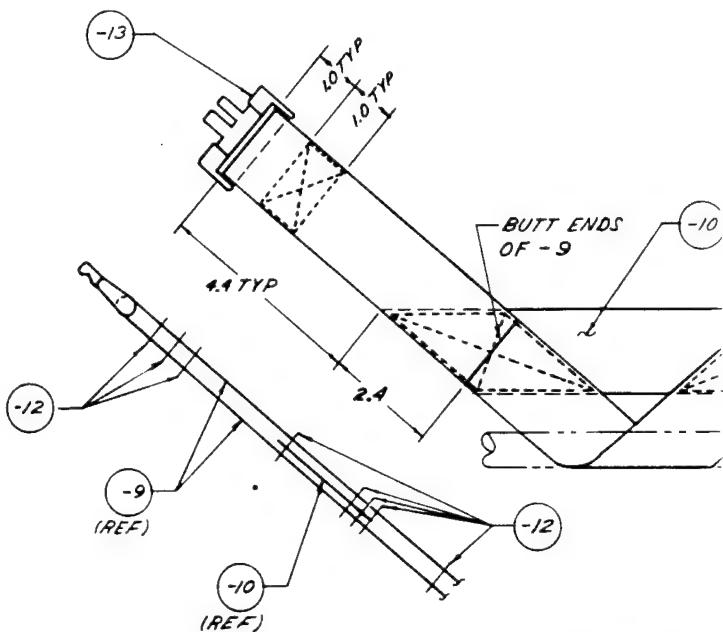
**-8 SHOULDER HARNESS STRAP ASSY. (2 REC)**

①

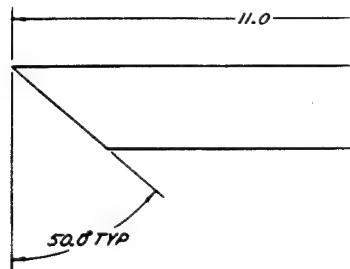
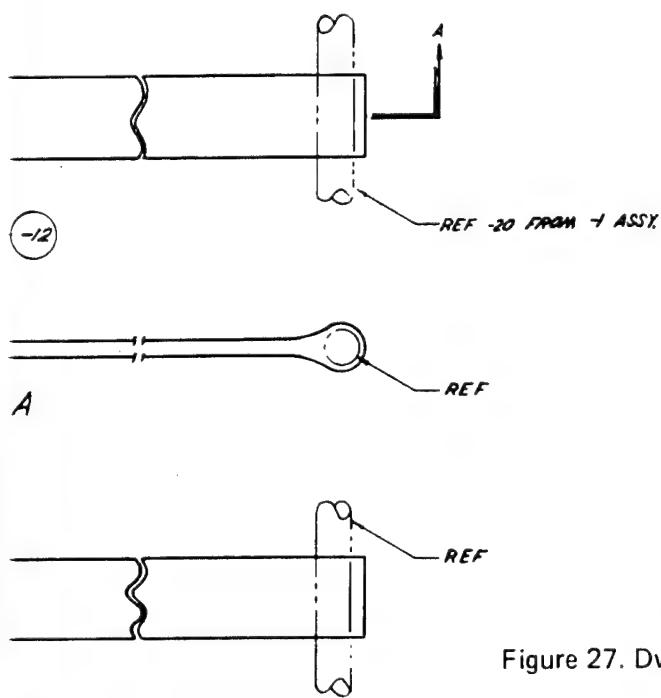
SIZE	MATERIAL	SPECIFICATION		
1 $\frac{3}{8}$ x 48	NYLON, SAGE GRN. WEBBING		MIL-W-4088 TY XIII	
1 $\frac{3}{8}$ x 11	" " "	"	"	"
1 $\frac{3}{8}$ x 54	" " "	"	"	"
	NYLON SAGE GRN., 6 CORD	V-T-295 NIIN 00-559-5211		
		P/N 015-11366-1 (NOCH)		
		P/N 015-710001-1 (NOCH)		

## 2 FORMING SHARP EDGES.

OF WEBBING.



-7 LAP BELT

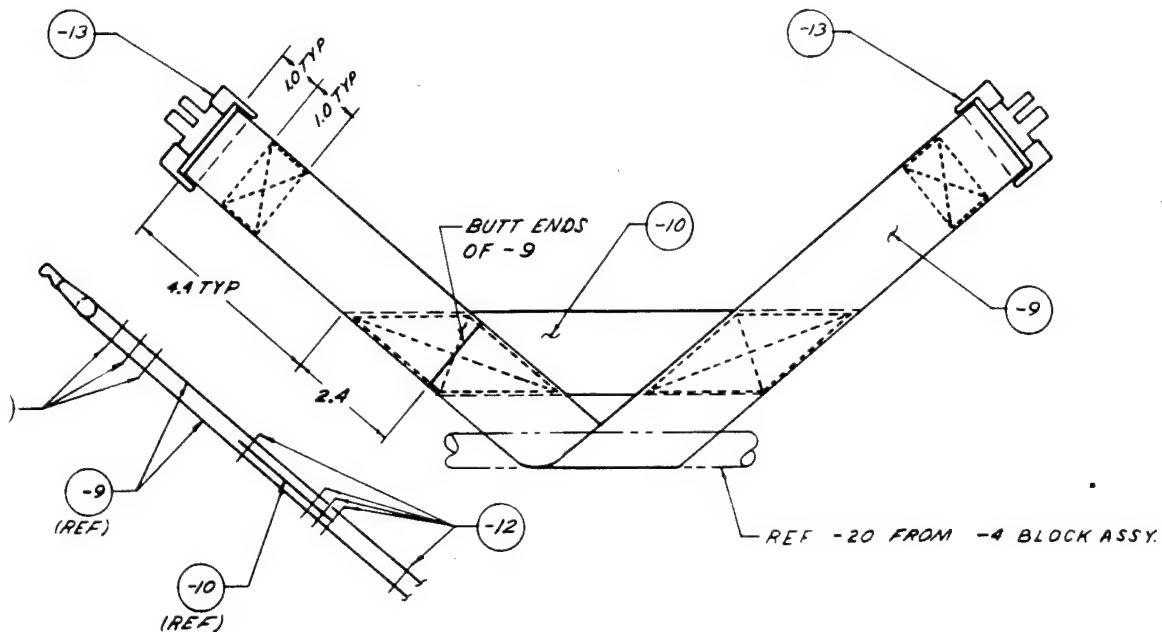


-10 CROSS

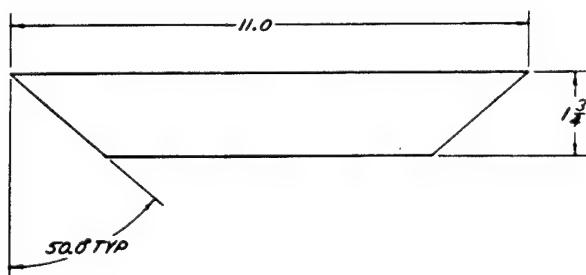
Figure 27. Dwg, S-3A Ballast Block, Strap Assemblies

SOLD TO: SPENCER, SPEC OF NO. 2 3 BINS HIGH AND 10 DEEDED. TOLERANCES ARE: FRONT LINE: ± ± PLATE: ± 1/8 INCHES ± PLACE: ± 1/8 INCHES		CONTRACT NO.
<b>DO NOT SCALE THIS DRAWING</b>		DRAWN BY
MATERIAL:		REVIEWED
		APPROVED
		MADE BY
SEE NOTE 19.		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



-7 LAP BELT STRAP ASSY. (1 REQD)

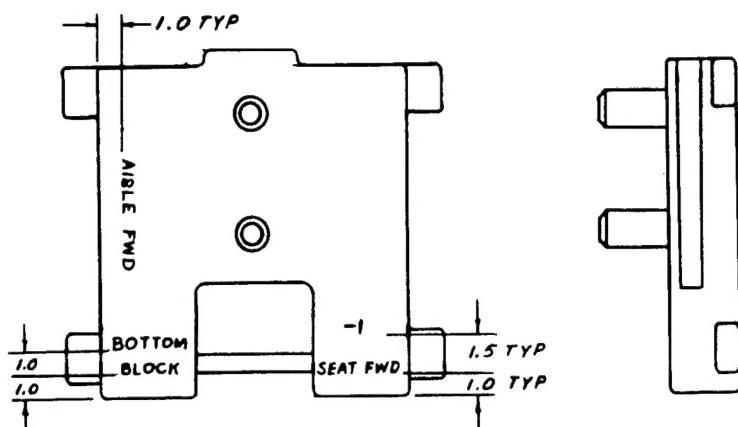


-10 CROSS STRAP

## **ock, Strap Assemblies**

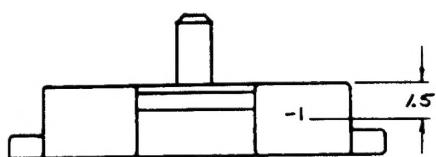
BALLOON APPROXIMATE SPEC OF HED 2 INCHES HIGH X 10 INCHES TELESCOPIC ANGLE		CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WARminster, PA. 18974	
FRAMING 2 ANGLES 2 2 PLACE SEC NAILS & 2 PLACE SEC NAILS 2			S-3A BALLAST BLOCK STRAP ASSEMBLIES	
DO NOT SCALE THIS DRAWING		DESIGNER <i>L. Martuccia</i>	REVIEWED <i>J. Ford</i> 4/18/83	APPROVED
MATERIAL:				SIZE SHEET NO. <b>80206</b>
SEE NOTE 19.				WORK SHEET NO. <i>S3ABB4/7</i>
		APPROVED	SCALE $\frac{1}{2}$	REV
		APPROVED	WT	ENTRY 7 of 8

D



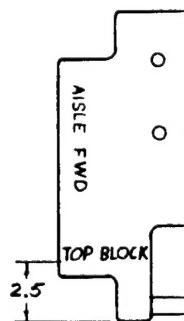
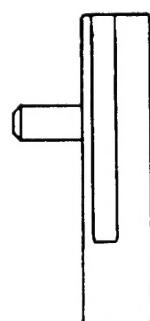
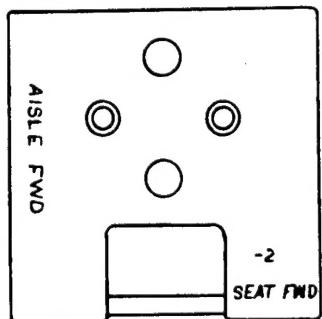
NOTE: 2A. CENTER ALL LABELS  
UNLESS OTHERWISE  
STATED.

C

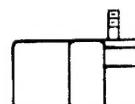
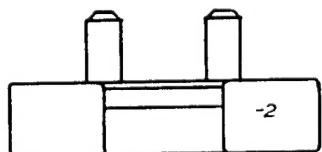


-1 BLOCK ASSY.

B

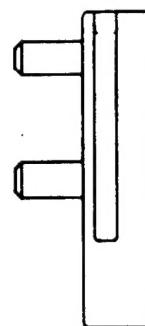
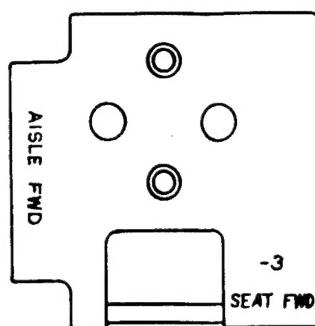


A

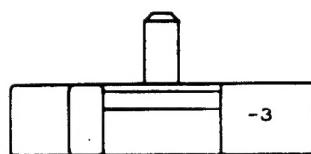


-2 BLOCK ASSY.

Figure 2E



ILL LABELS  
OTHERWISE



### -3 BLOCK ASSY.

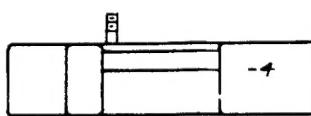
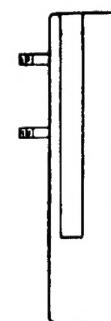
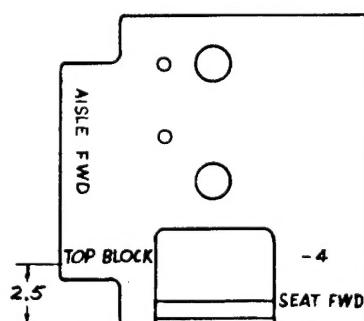


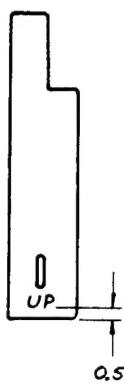
Figure 28. Dwg. S-3A Ballast Block, Stamping Detail

### -4 BLOCK ASSY.

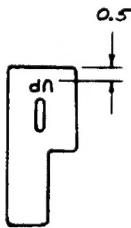
NOTES: 25. ALL STAMP.  
26. SEE -1 BLOCK.  
27. STAMPING N/A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONAL:                   ANGLES: 1 PLACE DECIMALS:           2 2 PLACE DECIMALS:           3 3 PLACE DECIMALS:           4	CONTINUED:
DO NOT SCALE THIS DRAWING	DRWNS:
MATERIAL:	CHRS:
N/A	SPCS:
	APPS:
	PPPS:

REVISIONS		DESCRIPTION	DATE	APPROVED
NAME	LTR			



-5 LOCKING PLATE



-6 LOCKING PLATE

NOTES: 25. ALL STAMPING IS  $\frac{3}{8}$  IN. HIGH  
 26. SEE -1 BLOCK FOR TYPICAL STAMPING LOCATION  
 27. STAMPING IS NOT DRAWN TO SCALE

DETAILS OF DRAWING SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: PRACTICAL ± ± PLACE DECIMALS ± ± PLACE DECIMALS ±		CONTRACT NO.	
		NAVAL AIR DEVELOPMENT CENTER WILMINGTON, PA 18774	
DO NOT SCALE THIS DRAWING		DESIGNER: J. QUARTIERO	APPROVED: D. Koenig 11/16/03
MATERIAL: N/A		S-3A BALLAST BLOCK STAMPING DETAIL	
APPROVED:		DATE: 11/16/03	APPROVED: S-3A BALLAST BLOCK
APPROVED:		80206	80206
		SCALE: 1/4	WT: 8.0
		DRAWING NO. 8 OF 8	

NADC-84015-60

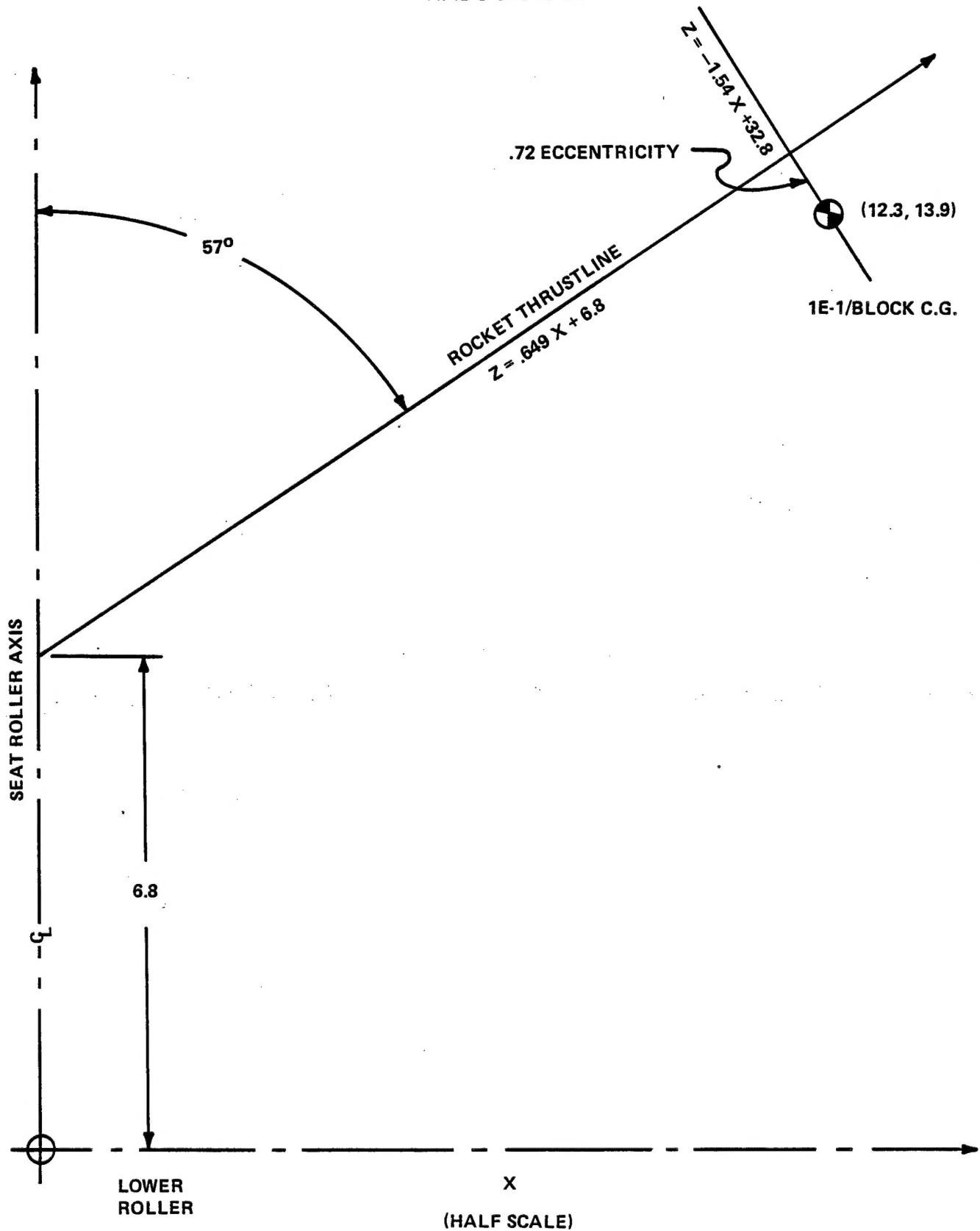


Figure 29. 1E-1 Ballast Block C.G. Eccentricity with Rocket Thrustline